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ABSTRACT

This guide was started in 1986 as an effort to pull together a collection of several computer guides that had been written over the previous several years to assist schools in making simple computer repairs. The first of six sections contains general tips and hints, including sections on tool requirements, strobe disk speed adjustment, static electricity prevention, suggested inventory procedures, physical security, suggestions for inventorying and cataloging software, and information on the district's in-house repair service. The next four sections provide troubleshooting and repair guidelines for computers manufactured by Apple (Apple IIe, IIc, IIGS, Macintosh, and the Image Writer and Laser Writer printers); Commodore (Commodore 64); IBM (and IBM-compatibles); and Tandy (TRS-80). The final section includes suggested readings (books and magazines), a guide to diagnostic software, and a list of training programs in computer repair offered by Apple, Commodore, IBM, and Tandy-Radio Shack with procedures for obtaining further information. The looseleaf format of the guide is designed to facilitate frequent updating. (GL)

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TROUBLESHOOTING MICROCOMPUTERS

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A TECHNICAL GUIDE

FOR

POLK COUNTY SCHOOLS

By

B. R. Black, Ward Hurst, and John Barber

SCHOOL BOARD OF POLK COUNTY
John A. Stewart, Superintendent
P.O. Box 391
Bartow, FL 33830

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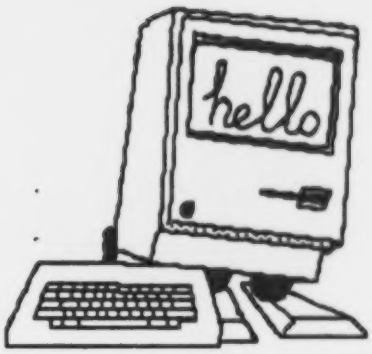

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In fact, about half of the words in this booklet probably already belong to somebody. However, the intent of the following paragraph is to prevent the commercial expoitation of any of this by the unscrupulous. Therefore....

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Change 3
September, 1988

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OLD:	NEW:
i, ii, iii, iv	i, ii, iii, iv
G-1 through G-14	G-1 through G-16
A-1 through A-12	A-1 through A-12
A-15 through A-24	A-15 through A-30
I-1 through I-14	I-1 through I-11
T-13	T-13, T-14
R-1 through R-4	R-1 through R-5

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i, ii, iii, iv	i, ii, iii, iv
G-1, G-2	G-1, G-2
G-10A	G-10A
A-1 through A-12	A-1 through A-12
A-15-16	A-15 through A-24
I-1, I-2	I-1, I-2
I-13	I-13, I-14
R-1 through R-4	R-1 through R-4

TROUBLESHOOTING MICROCOMPUTERS
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OLD:	NEW:
i, ii, iii	i, ii, iii, iv
	G-10A
A- 5, 6	A- 5, 6
A- 9, 10, 11, 12	A- 9, 10, 11, 11A, 12
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INTRODUCTION

This manual was started in the Fall of 1986, as an effort to pull together a collection of several computer guides that had been written over the previous several years to assist schools in making simple computer repairs. John Barber and Ward Hurst spent many hours writing the original versions of the guides which were adapted for these editions. I'm sure they shared my hope that each school would keep at least a single copy in a three-ring binder for use by teachers who use computers.

Note that the term "computer teacher" was not used. The editor was then of the opinion that computer teachers would eventually become specialized and they would only teach advanced computer topics in tomorrow's curriculum. They might remain the "Resident Wiz" in each school, but more and more teachers would learn to use the computer and share that knowledge with students in the process of helping students learn. Therefore, the need existed to have someone at each school knowledgeable about basic troubleshooting. That need has increased each year.

Second, while the repair of computers fell into the same category as the repair of projectors and tape recorders -- "It ain't my job...." -- the delivery of instruction was still being interrupted by the failure of a computer. Most teachers would attempt to check out a projector if the film stopped. Computers deserved equal treatment.

Finally, before a school sent a computer back to the dealer, the school owed it to its budget to verify that the computer indeed was broken. Many times, the problem was traced to a loosened cable, or sometimes even a chip damaged while the operator was performing another repair. The maintenance and replacement of computers was already a major school expense. Use of this manual, it was thought, had the potential to save a school several repairs during a single year.

In the perspective of hindsight, those original objectives have been met. Polk County has managed to reach a "critical mass" of computers which had made it possible to construct a district level electronic repair facility staffed by school-trained technicians. The initial savings to the district in just computer

repairs may be overshadowed by the potential savings from the repair of electronic typewriters (now mostly computer printers with keyboards attached) and electronic copiers (which share technology with laser printers). Technology continues to evolve and Polk County has been fortunate to have a superintendent and school board which have supported the sound use of instructional technology.

As in each previous edition, every attempt has been made to keep the information current. However, computers and disk drives change as fast as any other type of equipment. If you discover an error or have a suggestion that might be helpful to others, please write it down and send the suggestion to the address shown above. One of the purposes for punching the manual for a three-ring binder was so that small changes and additions could be made without a total reprinting. Simply remove the old pages and add the new. It is suggested that the listing of changes be kept in the front of the manual.

Special thanks to Alice Ray-Overstreet and the members of InterFACE, Polk County's chapter of the Florida Association for Computers in Education, who assisted in editing and field-testing portions of this manual.

I'm sure I speak for John and Ward in wishing that all your hardware bugs be small ones.

B. R. Black
Supervisor, Instructional Computing

GENERAL TIPS AND HINTS

by

Ward Hurst and B. R. Black

Microcomputers are useful, productive tools for educators and schools alike. Computers provide an innovative way of saving time while maintaining accuracy for administrative chores and are a tremendous instructional resource for teachers when used properly. If a computer fails to perform for "technical" reasons, however, confusion and complaining often result. Many educators really do not know what is wrong with the machine nor how to repair it. The teacher or the school is subsequently left with a high repair bill.

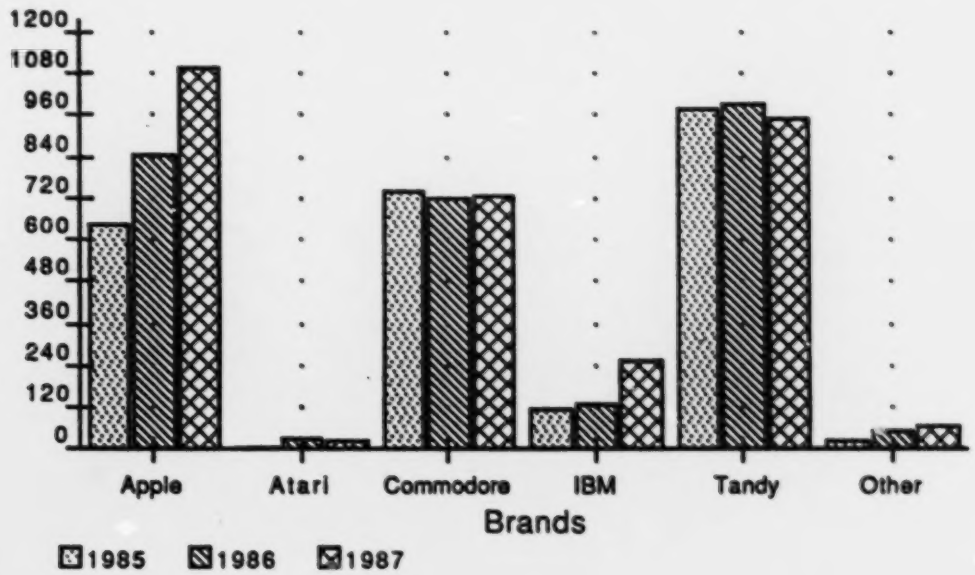

Figure 1

Instructional Computers – Polk County Schools
1985 through 1987.

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[1] Ward Hurst is Director of Secondary Education, Polk County Schools, and former Supervisor of Instructional Computing. He authored the first edition of this guide.

[2] B. R. Black is the current Supervisor of Instructional Computing for Polk County. He was formerly Supervisor, Management Information Systems.

Funds for the maintenance of computer equipment are being provided for the first time this year with the establishment of a district electronic repair center. Until now, each school could select a local maintenance vendor for the particular brand of computer(s) used by the school. While trained technicians will be available to assist schools maintain and repair computers, in the final analysis, each school will still be responsible for their own equipment - to include microcomputers and printers. If the equipment is not properly cared for, the students and staff of that school must do without the computers or printers until the equipment is repaired. To meet that need, teachers and administrators will still need to be trained in routine maintenance and care of computers.

Many times a minor technical adjustment could spare the individual or the district an expensive repair bill, and proper education on preventive maintenance could have avoided the situation altogether. There is also special technical training available to schools for computer contacts and other interested individuals. This training is discussed toward the end of this chapter.

The next few pages offer general suggestions which apply to all microcomputers. Hints and tips for specific computers are contained in the chapters that follow. They are the result of our district's desire to help the local teachers and building principals avoid frustration and to help the district avoid high cost repairs through proper equipment maintenance.

SPECIFIC SUGGESTIONS

The manner in which microcomputers are housed and maintained at the local school site directly relates to their successful use. There are two distinct approaches to this situation.

Computer Lab One method is to house the majority of equipment together in the same location with good teacher supervision and security. The thought here is that computers are somewhat delicate pieces of equipment that should not be subjected to constant movement from location to location on carts, etc. Jolts and bumps over a period of time can cause drive alinement and disk speed problems. Many administrators feel that computer equipment housed under one roof with one qualified teacher to maintain it and supervise all its use will provide them many hours of trouble-free use.

Classroom Distribution Many schools and/or districts prefer to place the computer in a single classroom with an individual teacher. Many educators feel this gives the computer exposure to a larger number of students. Some schools or districts, however, are limited in the number of available units for use and have to place them on portable carts and transport them from room to room. This does subject the equipment to more potential problems, but teacher familiarity with the selected computer system and its proper preventive maintenance should reduce this problem to a point where it is not significant.

During 1987-88 Polk County began to look for an integrated approach to computers and computer assisted instruction. There were monumental debates between the developmentalists who wanted computers to be dispursed into classrooms and the fundamentalists who maintained a lab approach would maximize use and increase efficiency. The glimmer of truth which appeared from time to time to prevent anyone from going ballistic was that really - bottom line - both sides were right! Computers need to be both in the individual teacher's classroom and networked into concentrated labs. Appropriate applications and instructional needs exist to justify both types of use.

The difference is that in our haste to get computers out to the students, most districts and school officials neglected to get computers and software into the hands of teachers. Those schools and districts that made computers available to teachers, that provided opportunities for teachers to attend computer training in proper instructional uses of computers, those districts will now begin to see a measurable difference in how students and teachers use computers. Schools need to reach a "critical mass" of computers or computing power in the case of networked systems to get beyond the level of one or two pioneer computer teachers.

Either direction, classroom or lab, remains a local school or district decision. The key fact to keep in mind is either choice still mandates user awareness and knowledge of how to take care of each piece of computer equipment. The difference is in the number of people that need to be trained. Polk County's present strategy toward computer assisted instruction has made provision for a well trained paraprofessional to work in the lab to assist teachers with the technical aspects of the lab. The objective is to allow teachers to concentrate on teaching students - not being worried with the details of the technology. As teachers become more familiar with computers and other forms of instructional technology, and as computer networks become easier to use, the dependance on paraprofessionals and the need for technical training will diminish.

Until then, each school needs to officially appoint their local computer guru as the school's computer contact. The contact can act as a liason between the district technology staff and the local school, and given a small portion of the school's inservice budget, he or she can be the local training resource to assist teachers within the school. Some schools and districts have even (gasp!) appointed a computer or technology advisory committee to provide teacher input into decision making. At least one Florida district has monthly meetings and/or training sessions and idea exchanges for school level computer contacts.

The ultimate responsibility then remains with the school to train teachers and students to use computers effectively. The district can help, it can advise, it can provide training, but what goes on in the classroom or lab after the bell rings and the door is closed remains the responsibility of the school. No amount of leadership from the district level can change that responsibility.

Dust Covers Use dust covers on all equipment not in use. Plastic garbage bags liberated from the custodial closet were not "elegant," but they saved 14 computers from a bath when a classroom roof leaked during a heavy rain.

System Configuration Know the system's configuration -- what it takes to hook the computer system together. Many times a "broken" computer is simply not properly connected to its interfaces. Check cable connections, dip switch settings, and installation or set-up routines for the specific machine. Many of the standard dip switch settings have been included in this guide.

Printers and Ribbons Keep your printer clean and use good quality replacements when print type is faded or the original ribbon breaks. Do not attempt to restore a ribbon with stamp pad ink or with home remedies. If you dirty the print head it will require a through cleaning.

> NOTE - You may have heard how WD-40 was used one dark night to extend the life a printer ribbon being used to complete a term paper. It works for while...but is not generally recommended! Ribbons are less expensive than print head replacement.
>
> On the other hand, a single drop of WD-40 or other high quality machine oil applied to the bar the print head slides across is often helpful. The key is to use good judgement.

Disk Drives Clean the read-write heads of your disk drives and check the disk speed every three to four months or every 40 hours of use (even more frequently if the environment is dusty).

1. Use denatured 90% alcohol and foam or chamois tipped swabs. (Cotton tipped swabs will leave lint on the heads.)

2. Set d-speed to proper specs with purchased software or use the strobe method outlined elsewhere in this guide.

3. As a general rule you do not need to use a head demagnetizer.

4. In general, any program that is to receive significant use should not be placed on the flip side of single-sided disk. This causes the "flippy" diskette to spin in the opposite direction and places dust and trash back on the read-write head causing more frequent cleaning. Many people (including Apple Computer, Inc.) use a "flippy" for short start-up routines or for archive storage of data disks.

5. Use good quality diskettes.

6. Do not lubricate the inside of the drive. You can, however, clean many internal parts with alcohol or head cleaner.

7. Rotate the pressure pad and replace it if it is very worn.

8. Smoking around your disk drive can contaminate the drive arms (the shiny rods upon which the read-write heads move back and forth) and the read-write head.

NOTE - In general, do not blow smoke directly into the disk drive slot at close range. Suspect anyone who says otherwise to be an anti-smoking fanatic. I would worry more about dust from carpets.

Heat, Magnetic Fields, and Peanut Butter Do not place your diskettes on your monitor (or TV set), disk drive, or such devices as a graphics tablet. Their magnetic fields can erase or alter your media. Many pieces of office furnature are now built with mangetic latches. Remember that diskettes do not get along well with finger prints, dirt or dust. One should never touch the exposed diskette surface and diskettes should always be stored in their jackets, in an appropriate container, and away from extremes of heat. Temperatures above 125°, such as are found in direct sunlight on a car's dash, will damage disks.

Even the new 3.5" disks with their hard protective jackets need to be treated with care. The metal shutter that closes as the disk is removed from the computer eliminates the need for a separate paper envelope to protect the disk. But the hazzards of magnets, unwatched coffee cups, and heat still lurk for the unsuspecting. A 3.5" disk will still warp if left on a car seat in the sun.

Surge Protection Invest in a good surge protection power bar or internal surge protection for your computer systems. Remember the only real protection against lightning is to unplug your system when not in use or during electrical storms. Surge protectors are only for those instances when lightening strikes some distance away, or there is an unexpected surge when a piece of equipment is suddenly turned on. There are no surge protectors that will protect computer equipment under all circumstances. A direct hit by lightening is just beyond the scope of most surge protectors.

NOTE - Lightning will also follow telephone lines into a computer system. A lightning strike two buildings distant found a phone line, wiped out the modem, entered the computer through the modem's serial port, and wiped out three chips before being dissipated. The surge protector had been pulled from the socket when the storm started, but the operator forgot to pull the phone plug.

Extension Cords Do not use common household-type extension cords or electrical outlet expanders to "jury rig" power to your system. At least use good quality surge protected multiple outlets. Try to have electrical lines for power to a lab that are separate, grounded circuits, not connected to the lights of the room, etc. I once saw a computer connected on a single multiple outlet with an overhead projector, a 35mm slide projector, and a printer and the room lights on the same circuit. The old circuit breaker located down the hall couldn't take it either and was eventually replaced... but not before the teacher learned to frequently "Open Apple - S" to save the data to disk.

On or Off"? Frequently, new computer users ask if they should leave the computer on all day long, or turn the computer off when not in use. According to the experts, switching the computer on in the morning and leaving it on all day will cause less stress on solder joints and electronic components than frequently turning the machine on and off. I know of some networked computers that are on protected circuits that are turned off only for system or program maintenance. They run for weeks and months at a time with no apparent ill effects.

Monitors, on the other hand, will "burn in" if left on all the time. It's O.K. to turn the monitor off, or dim the screen when the computer is not in use. I have one of several programs rigged on each of my computers which turns off the screen when the computer is not used for two minutes. As soon as I hit a key, the monitor turns back on. Several such programs are available. They certainly appear to save the little screen phosphors

In the event of...FIRE!!! Keep a HALOGEN fire extinguisher in the lab at all times to handle possible electrical fires. Halogen extinguishers do not "dust" the electrical components, rather, halogen extinguishers use a clean inert gas to deny oxygen to the fire and to cool things down.

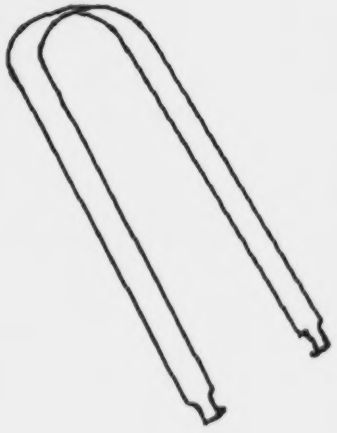
Aline the slot or "U"- shaped indendation with the similar indentation on the socket. Pin Number 1 is sometimes marked with a single dot. Aline the dot (pin 1) on the chip with the dot on the circuit board.

Figure 2

IC Installation

If you really have to do it... If chips are removed from the mother board or a drive analog board for any reason, be sure to reinsert the new chip with pin one in the proper position. Pin one is marked with identification of some kind such as a dot or an indentation. The socket on the mother board carries a similar marking or indentation (Early model Apple chips are often marked with a white dot).

If you pull a chip, use an IC puller to avoid pin damage if possible. Rock the chip gently while maintaining an upward pressure on the puller. The new chip installers often have two slots on one side to assist in straightening bent pins. Add-on boards or expansion cards are pulled much the same way. Rock the card back and forth (longways) in the socket while maintaining a slight upward pressure.



CHIP PULLER

To remove chips, use a rocking motion with a gentle upward pressure. Try to avoid bending the pins on the chip.

Figure 3

Chip Puller for IC's

NOTE - It sounds silly, but make sure the computer is turned off before pulling chips, interface cards, or cables. Apple even has a red light emitting diode (LED) next to the power supply on the rear of the mother board to remind "would-be" technicians if the circuit is still hot. IBM unwittingly provided an audible signal with their fan motor...often heard in the next room!

One or two of the long IBM-type cards have components very close to the end of the circuit board. So close in fact, that if the card slips while being extracted, a ceramic capacitor can be cracked and the card permanently disabled. One such card is the AT's combined floppy - hard disk controller. It's an expensive card!

COMPUTER TEACHER'S TOOL KIT

The following items are suggested as "basic issue" for each computer teacher for routine USER maintenance of equipment. (Part numbers and prices current as of August 1986.)

1. Denatured 90% alcohol or "professional" tape head cleaner
   Pro Solvent [Radio Shack 44-1171 - $2.39]
   Alcohol Head Cleaner [Radio Shack 44-1010 - $0.99]
2. Foam or chamois tipped swabs [Radio Shack 44-1094 - $1.95]
3. Small plastic (insulated) handled screwdriver for drive speed adjustment. The type and size used for making repairs to eye glasses works quite well.
4. Regular and Phillips head screwdriver (insulated handle and non-magnetized tip). [Radio Shack 64-1950 - $2.49]
5. Insulated needle nose pliers. [Radio Shack 64-1847 - $3.99]
6. Chip puller for socketed chips and chip installer (optional). [Radio Shack 276-1574 - $6.95]
7. Drive speed calibration software or familiarity with the strobe method described in this chapter.
8. Fingernail polish to coat any adjustment screw that is reset.
9. Apple nut and socket tool (usually included with the super serial card). And if the operator is qualified...
10. Soldering iron and vacuum type solder removal tool for non-socketed chip removal.
    WARNING - ANY MODIFICATION OF YOUR COMPUTER OR ITS PERIPHERALS WILL VOID THE WARRANTY.

STROBE DISK SPEED ADJUSTMENT

There are several disk utilities for each brand of microcomputer that contain disk drive speed adjustment routines. Even if you don't have such a program, there is a simple method that works effectively.

Most drives have a 50/60 Hertz (Hz) "strobe" pattern on the large pully or flywheel underneath the drive assembly. When the drive is engaged, this pully is connected to the disk hub ring holder, and is therefore a direct indicator of disk speed.

1. Expose the bottom of the disk drive assembly and boot a disk with no program (Apple) or load a long program (C-64). There is enough 60 Hz flicker from American A-C powered florescent lighting to obtain a reading from the markings on the pully. Do not attempt to use sunlight, battery powered lamps, or rectified energy saving lamps to obtaining a reading from the strobe wheel.

2. Locate the speed adjustment potentiometer screw (if the drive has only one adjustment screw, that's probably it) and turn it in small increments until the pattern made visible by the 60 Hz marks on the pully is stationary. If the adjustment is not correct, the strobe pattern will appear to move in one direction or the other. The speed at that point is set to about 300 rpm, which is standard for Apple and Commodore drives. The technique also works on IBM drives.

NOTE - Apple's new Unidisk and the older, no-longer manufactured Duodisk have a hole in the bottom of the cover just like the Apple IIc to provide access to the disk speed adjustment screw. This allows adjustment using a tiny screwdriver and an adjustment utility disk.

Both of the newer disk drives are more difficult to disassemble and the use of a cleaning disk is being recommended. Be sure to follow the directions furnished with the disk drive cleaning kit for your particular machine. For example, Apple IIc and IIe drives are single sided - only one side of the cleaning disk is exposed. The top side of the cleaning disk is usually not exposed to protect the felt pad that holds the floppy disk against the read-write head. Late model IBM drives have two read-write heads per drive and both sides of the cleaning disk are exposed.

STATIC ELECTRICITY - A MICRO KILLER

Many stories abound about static electricity and what it can or cannot do to a microcomputer or disk drives. Some facts relative to static electricity, (or electrostatic discharge) are covered in the Apple Computer Level I service training course:

1. The smallest charge that you can
   a. feel is 3,000 volts.
   b. see is 5,000 volts.
   c. hear is 10,000 volts.

2. Many micro circuits are sensitive to as little as 500 volts of electrostatic discharge, which is 1/6 as little as one can feel.

3. Always ground yourself before working on the inner parts of a computer, disk drive or printer by touching grounded metal. Remember that if you pick up and replace your foot after doing this you can regain a charge. The best ground is a wrist strap ground [available at Radio Shack, Part Nr. 276-2399 - $1.99].

4. A charge of static electricity can come from you, from your clothing (especially polyester), or from such common items as styroform cups or cellophane tape. You should never allow these items into the working environment, or wear polyester clothing while working on the inside of a computer.

5. Never touch anyone who is working on the inside of a microcomputer. You could transfer a static charge to them.

6. If the environment in which you keep your computers is producing a lot of static electricity problems, consider purchasing floor mats that are protective and insulating. These are available from various manufacturers, but can be quite expensive.

CRT AND THE DANGER OF IMPLOSION

The cathode ray tube (CRT) display that many computers use is in reality a large glass envelope with all the air removed. If the glass of the tube is broken by any means, the resultant glass pieces will be forced inside and will bounce off of the inner walls of the tube with tremendous force that will then propel a shower of glass particles outward. This is known as an implosion and is extremely dangerous to the eyes. The front of most CRT's is a safety glass shield to protect you from this danger.

The second danger is from the anode, an electrical connection on the bell shaped portion of the monitor. The wire leading to the anode is about the thickness of a sparkplug wire on an automobile engine, and has a thick rubber cover. The stored energy even after the monitor is disconnected can exceed 12,000 volts.

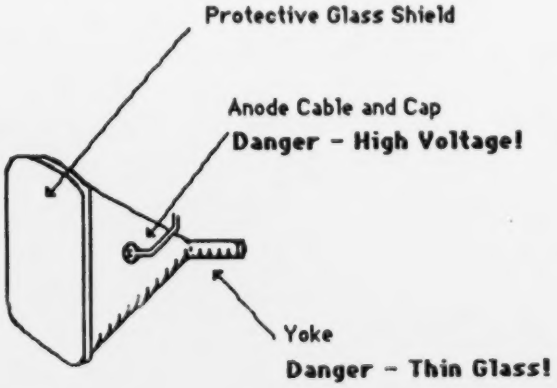


Figure 4

Cathode Ray Tube (CRT)

In fact, some manufacturers do not recommend any user maintenance of monitors due to these two dangers. IBM, for example, suggests that all its monochrome monitors be repaired by their own trained technicians. Even the vertical hold adjustment is inside the case with no provision for reaching the control from the outside. Other manufacturers at least provide access to the common monitor controls and adjustments outside the case.

However, if you must work on the inside of the monitor, to change a fuse or to remove the tube itself from its housing, you should adhere to the rules listed below. Again, most of the rules are from the Apple Level I training course.

1. First, remove all students from the vicinity. **This is one of B.R.'s ABSOLUTE rules - absolutely NO EXCEPTIONS!**

2. If you work inside a monitor, and the CRT is exposed, always wear safety goggles (not just safety glasses) to protect your eyes against the danger of an implosion.

3. Never touch or pick up the CRT by its neck, where it is extremely thin in construction.

4. Remove all rings, bracelets, wristwatches, or other jewelry when working on a CRT. Do not wear a grounding strap while working on a CRT. Jewelry is a carrier of electricity and remember, some CRT anodes carry a charge of 12,000 volts until discharged.

5. Always discharge the anode by the manufacturer's approved method before working inside the monitor. NEVER touch the anode! Keep one hand in your pocket or behind your back when discharging the CRT to protect your heart from the danger of electric shock.

NOTE - In 1987, Apple sent out a safety notice to all its technicians regarding the Macintosh SE. The SE has the video board attached to the rear of the CRT. Apple advised that the video board be removed from CRT before attempting to install an additional module inside the SE chassis. The SE is a small computer, things get tight inside, and if the video board gets bumped hard enough to crack the rear of the tube, the CRT could implode. Safety first folks!

MANUALS

Every computer and printer that I have ever taken out of a box that came directly from the factory had a manual or set of manuals in the box when it left the factory. The manuals are designed to assist the owner in installing and maintaining the equipment. Some manuals are designed to assist the owner in understanding the software.

There is little sympathy to waste on those who had the manuals at one time, did not take care of the manuals, and allowed the manuals to be lost. Any sympathy that remains is for those who inherit a piece of equipment or software sans manuals. The warning implied is for all computer owners or operators to take care of the manuals and other owner's guides that are furnished with computers.

Some of the largest "headaches" can easily be resolved if the proper directions are available. For example, the 9-pin serial port on a Kaypro PC is different from the 9-pin serial port on an IBM. The ports look exactly the same. The function each pin performs is slightly different and a cable originally designed for one computer will fit, but may not work, on the other computer.

The fact that both computer companies once used the same RS232 serial port standard and the modem used to work on either computer had nothing to do with it. It was not until both the IBM and Kaypro manuals were consulted that a perfectly good 1200 baud modem was exonerated and a proper cable fabricated.

THREE TESTS TO PERFORM WHEN YOUR COMPUTER STOPS WORKING

1. Check the cables.
2. Check the cables.
3. Check the cables.

Thanks and a flip of the disk to:
Jeff Lake, Illinois Vocational Curriculum Center, Sangamon State Univ. Springfield, IL 62708

SUGGESTED INVENTORY PROCEDURES

Few schools and property custodians were prepared for the influx of computers into schools. Movie projectors and typewriters were single pieces of equipment. There was usually one serial number and records were easily maintained.

Computers, on the other hand, may consist of several pieces of equipment each with a separate serial number, or it may be a single box with only one number. To further confuse the issue, additional cards or circuit boards may be added which increases the value of the computer. Printers are normally attached to a computer system and normally will have different serial numbers than the rest of the system. Part of the problem is that a computer will be ordered as one item, delivered in one box, be listed on the inventory as a single item, and can be installed as five separate pieces.

The following are a few guidelines that may make the property custodian's life easier and will help when it's time for the annual inventory. Each individual computer component should have its own district BPI (District ID) number if:

a. It has its own serial number and...
b. It has a value of over $100.00 dollars.

For example, a Kaypro PC with a 20MB fixed disk was purchased in a "bundled order" which included the computer, keyboard, monitor and software for a purchase price of $1800.00. Only one BPI number was issued based on the purchase order and other documents showing only a single system. However, the auditors ruled the monitor with its own serial number and a value over $100.00 should have been issued a BPI number also. The value of the monitor was a proportional share of the total purchase price:

Computer w/ keyboard	$1600.00
Monitor	200.00
TOTAL	$1800.00

In another example, an Apple IIe Unidisk Pro-system was purchased for classroom use. Again, this was a bundled purchase with a significant saving over the purchase of individual items. The bundled price was $1499.00. The value of the individual items was $2141.00. Since the documentation indicated a single item, only one BPI number was issued. In fact, the system consisted of:

Computer	$ 945.00
Unidisk w/controller	568.00
Unidisk (second drive)	499.00
Monitor II	129.00
TOTAL	$2141.00

NOTE - Polk County auditors have suggested that a package deal or "bundled system" should be ordered as specified by the dealer or catalog. Then underneath the description on the same PO type in the words "consisting of:" and list the major components of the bundled system. The list will alert property accounting to issue more than one BPI number for the system. After all, the clerk in property records only has copies of the PO to use. They never see the actual system or the components.

The message to each teacher with a computer, each principal and his or her designated property custodian, is that an accounting of computers should be maintained at both levels. The teacher should maintain an up to date list of the computer equipment (to include each piece with BPI and manufacturers serial number) for which the teacher is responsible, and the teacher should give a copy of the list to the property custodian. The property custodian should in turn reconcile the several lists with the computer equipment assigned to the school. This should be a routine procedure for the start of the school year and again at the close of school in June.

NOTE - When I was a science teacher, I used to keep track of all the biology equipment on 3 x 5 cards. If an expensive item was loaned to another classroom or another school, you can bet I had a record of the transaction. Today, I'd do the same thing on a database and hand the printout to the property custodian.

The old rule in the Army was to have the equipment or a piece of paper with a signature to show where the equipment is to be found. That's still sound advice today. Equipment being returned to the dealer for repair, checked out by a teacher for a project over the holidays, or being transferred to another school should verified with the proper paperwork.

PHYSICAL SECURITY

A computer lab, no matter what its other advantages, remains a significant target for thieves. The following ideas and suggestions have been used by schools to protect their computers:

1. Select a room in the school's interior if possible. The computer lab will most likely require air conditioning anyway. If the lab is located along the exterior, consider a room with small windows or use of decorative metal grill work to provide additional security.

2. Place the computer lab under the protection of the office alarm system. Depending on the type of alarm system, the lab may or may not have individual access. (Some require the office alarm be disarmed before entering the computer lab.)

3. Individual computers and printers may be secured in a variety of ways:
   a. Computer furniture with covers or doors designed to be locked.
   b. Covers that fit closely over the computer or printer and are bolted to the table to prevent the removal of the computer or components from within the computer case.
   c. Steel cable systems that connect the computer, keyboard and monitor to the table or desk. The cable on some systems may not be removed without damage to the computer case and the value of the computer thus reduced if stolen.

4. Make it a habit to lock the door when not in the lab. A super serial card will fit in a coat pocket. An 800K disk drive will fit in most coat pockets or a purse. Disks evaporate into thin air!

A WORD ON SOFTWARE

Software represents a significant investment at each school. Thousands of dollars have been spent from budgets at all levels to provide students access to educationally sound programs.

As a general rule (and unless there exists a very sound reason for the exception) ALL software received by a school from ANY source should be inventoried, cataloged, and then signed out through the school's library or media center. This procedure offers several advantages:

1. The software, like a book, filmstrip, or any teaching tool becomes a part of the school's collection and all teachers may gain access to the material. Even if the software is provided by compensatory education funds or some other special account that restricts the use of the material to certain target groups, the software should be cataloged and placed on inventory.

2. The media center should stamp the school's name and address on the software manuals and on the disk jacket.

> NOTE - In one of the early cases of computer theft to hit Polk County, the only way the police were able to connect the thief to the crime was the software manual and program disks were stamped "Frostproof High School Library". (Thank you Mrs. Todd!)

3. The library is still the school agency best equipped and trained to keep track of software, which usually consists of books, disks or cassette tapes.

4. Large schools may find it impractical to have the media services staff maintain the software inventory. If the principal determines the best procedure is to "departmentalize" the software inventory, he or she should also insure that each inventory is kept current. The list should contain the serial number of the program disk if any, (Oh yes, they may have numbers too.) and who has physical possession of the software. The software and manuals should also be marked or stamped with permanent ink.

IN-HOUSE COMPUTER REPAIR SERVICE

August, 1988 marked a significant change for Polk County Schools. The number of computers within the district reached a point that it would be more economical to repair the computers from a central electronic repair facility. The new "Electronic Equipment Repair Service" is responsible for the repair of all microcomputers and peripherals.

Each school was asked to reappoint a computer contact - usually the same computer teacher contact that has always been involved with microcomputers - so that computer repairs could be funneled through a single person at the school who would be familiar with the background of the computer problems. For example, if a community has frequent power surge problems due to being located at the end of the power grid, that information might help the technician isolate a computer's problem. The person most likely to know about computer problems is the school's computer guru.

Since the administrative computer infrastructure of terminals, microcomputers and local area networks is so complex and computer difficulties often involve the interaction of network software as well as hardware, ALL administrative computer problems will continue to be channeled through the Help Desk in the Information Services office (534-2349). As the district has come to be so dependent on the administrative microcomputer network for collection of student data and records, administrative repairs are expected to assume top priority.

Instructional computer repairs are usually not quite as urgent as administrative computer repairs. Routine (non-urgent) repairs can be scheduled by the repair center in a logical manner with more efficiency than sending the repair trucks bouncing hither and yon all over the county like a large yellow rubber balls. Unless it is a dire emergency, schools are asked to complete the Computer Repair Request form and forward the form to the repair service office in the Warehouse and Distribution Complex.

If there is a real emergency, for example, a parent's night program is this evening and your network file server has just started to make a strange grinding sound, call the computer repair service at 533-7751 or 533-8699, and please be ready to answer the following:

Type of equipment
Manufacturer
Model number
Serial number
County ID number
Problem description (as specific as possible)
Location of the equipment
Contact person
Contact person's phone number

Computers still under warranty are repaired by the vendor.

NOTE - Apple, for example, expects the "installing dealer" to help set up the equipment, test the equipment, and if the equipment doesn't work, the technician will usually return the equipment directly to the shop for immediate repair. The dealer collects a fee for that service directly from Apple. Some other companies (you know who, for example) didn't use to provide that service. Maybe they should have considered it.

APPLE COMPUTERS

by

B. R. Black and Ward Hurst[1]

A technician once told me that about 90 percent of his service calls were "user related." Most of what people refer to as "computer problems" were really the result of the users not knowing what to do, and many of his calls could have been solved by anyone with a little training, a little logic and dash or two of common sense. He was increasing his family's standard of living by checking cable connections, cleaning disk drives, and replacing a few chips and an occasional circuit board...thank you very much.

The following is a collection of notes, hints, and examples from a variety of sources - Apple Level I training, magazine articles, even melting a few chips ourselves. The only problem with the school of hard knocks is the cost of the tuition. The purpose of this section is to reduce some of that expense.

Keep in mind that most computer chip failures will occur during the first 90 days -- the period covered by warranty. If a problem appears during the warranty period, contact the installing dealer immediately. Apple Computer Inc. pays for warranty work--not the school board, if discovered in time!

Another factor to keep in mind is that for the past two or three years Apple has extended the warranty for computers shipped and installed during the summer months. Computers installed between June 1st and August 31st, but not placed into service before September 1st, are eligible for an extended warranty until November 30th. Two rules were tied to this program. First, the equipment was shipped through the Apple Education Purchase Program, and second, an authorized Apple Dealer opens the boxes and installs the equipment. Check with your local education dealer or district office for additional details.

APPLE IIe COMPUTERS

Remember, the caps lock key must be in the down position to properly use many pieces of Apple software.

If you decide to look inside the computer, never touch anything on the inside of the IIe until you have grounded yourself by touching the power supply (it is grounded metal). Leave the computer plugged into the wall to maintain a good ground on the power supply.

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[1] The notes on Apple Computers were originally developed by Ward Hurst and expanded by B. R. Black. Both Hurst and Black have served as classroom teachers, and as school and district level administrators.

Never remove any card from the IIe's various slots while the power to the IIe is on. Look for the red LED on the main circuit board next to the power pack! If the red LED is on -- turn the computer off. Pulling a card with the power still on can push a 12 volt surge of electricity through a circuit designed for .03 volts and will blow a chip on the card itself or on the logic board of the attached interface item. With the Disk II, for example, it can blow chip 74LS125 and cause the drive to erase any software booted from it. It can also blow one or more chips on the motherboard, or other chips on the Disk II analog board (the circuit board above the disk drive).

Normal interface slots for peripheral devices to be connected to the Apple IIe are as follows:

Slot 1 - Printer
Slot 2 - Modem
Slot 4 - 3.5 Disk (if added)
Slot 6 - Disk Drives (Look at the numbers. It is still possible to find disk controller cards in slot 7 in Apple computers that aren't working very well.)

Never touch the metal fingers (contacts) of the interface cards as dirt or oil from your hand could cause a poor connection. I had always heard that a pencil eraser could be used to clean contacts that had become corroded. However, if I suspect the contacts on a card problem, I try removing and reinserting the card once or twice. The contacts will usually reestablish the connections themselves. If removal and replacement does not reestablish contact, use a liquid contact cleaner and a clean cloth. Don't use the eraser from your kid brother's pencil.

Apple (and IBM) ship the interface cards in a protective antistatic plastic envelope. The card should remain in the envelope until ready for installation, and should be put back in the envelope or in a similar protective envelope or bag if removed. Remember static electricity?

Having a printer problem? Always check the dip switch settings on the super serial card and related interface devices (printers and modems) to be sure they are accurate before you send an Apple computer or printer back for repair. Then check the cable connectors to make sure they are clean and tight (push in and out a couple of times and then retighten the screws). See the diagrams at the end of this section for suggested configurations.

If you have even the slightest suspicion that someone has removed and replaced a chip, scan the circuit board for chips installed backwards. Remember, pin 1 on the chip is marked, usually by a dot or U-shaped cut. Also scan the motherboard for cuts or gouge marks which could have cut an electronic circuit trace.

The Apple IIe will, at times, display "computer garbage" on the screen if switched on and off too quickly. To a new computer user, this normally results in a reaction similar to heart failure...tightness in the chest, lump in throat. Should

this occur, turn the computer off, wait 10 seconds (count), then turn it on again. "There, doesn't that feel better now?"

The Apple IIe has a built-in self test that can be run by depressing the closed (solid white or solid black) apple key together with the control and reset keys. After several visual displays on the monitor, the message of "Kernal OK" or "System OK" will appear on the screen, or a specific error message with the location of the chip problem on the motherboard. If you have one of the new "battleship grey" IIe's with a built-in numeric key pad, use "Control, Option, Reset".

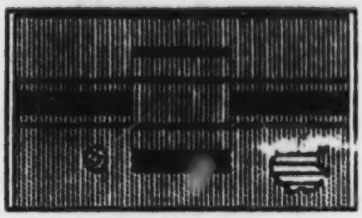
Many IIe motherboard problems are directly related to the failure of one of its eight 64K 150NS ram chips. The IIe self test (Control-Solid Apple-Reset) will identify a defective ram chip most of the time.

If you still suspect a IIe motherboard after all of this, med-evac the computer to the nearest "get well quick" repair center. The Polk County district office has a card that allows further diagnostics of IIe motherboard related problems. However, there are sometimes problems that require the motherboard to be replaced. This is happening more frequently now that most of the ram chips and other frequently replaced chips are being soldered into the board instead of being fitted into sockets. Most of the time, it's still less expensive for Apple to replace the board than to pay the repairman to really troubleshoot the entire board chip by chip.

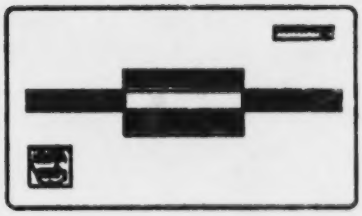
NOTE - Some programs or upgrades require an "enhanced" IIe. To check to see if the system is in fact a IIe enhanced, boot the system. If you see "//e" on the screen, the system is enhanced. If "][e" is displayed, the computer is "unenhanced".

APPLE DISK II, DUODISK & UNIDISK

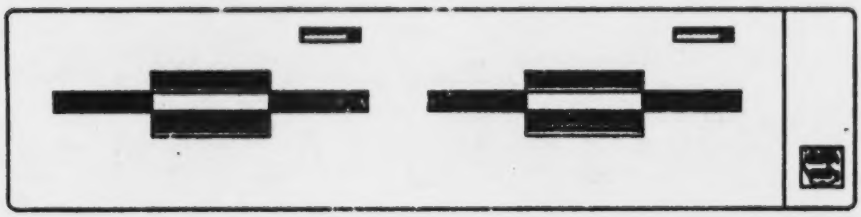
The much respected Disk II is no longer being manufactured by Apple. If your school plans to upgrade single disk drive machines to two disk drives, be aware that Disk IIs work with each other but not with the new Unidisk controller card or Unidisk drive. The new second Unidisk daisy chains into the back of the first Unidisk connected to the Apple. The following summary may help:



Disk II - Black front face plate, garage door type latch, metal case, ribbon cable out the back to physically connect with a disk controller card inside the IIe. Only four screws must be removed to uncover the mechanicals to clean the heads and adjust drive speed. The four chips that run the drive are easily replaced. Treat these drives with respect. As a design they have lasted a long time and are easy to repair if problems develop.

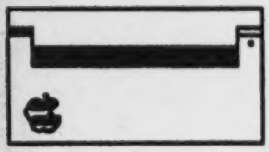


Unidisk - Tan face plate with push-in type latch. Round cable out the back which connects to a D25 connector fastened to the outside of the IIe case. D25 connector on the rear of the drive to connect an additional Unidisk to build a two drive system. A little more work to get into and clean. Cleaning disk recommended in most cases since the Unidisk allows an external drive speed adjustment.



Duodisk - I will refrain from printing my personal opinion out of the high regard I have for other Apple products. However, I hope the designer of the Duodisk is no longer employed in the computer industry. If you happened to have purchased one or two before being warned... the Duodisk has two disk drives in one box, both controlled by the same printed circuit board, and with a single cable to the D25 connector used in the Unidisk controller card. It fits on top of the Apple IIe (width is just right) and looks strong enough to support any monitor under 25 inches wide. It isn't, and it won't, and if you have a Duodisk, several of us have started to suggest that the monitor or the Duodisk find separate resting spots and that they NOT be stacked on top of one another. The Duodisk is also difficult to enter and clean. A cleaning disk is recommended. External drive speed adjustment is allowed

NOTE - If you reboot with an Open Apple - Control - Reset with some of the Duodisk drives, (those with analog boards with part numbers 676-X101 and 676-X102) you may damage the disk by writing over the program. (Oh, you've noticed that already...) If you haven't yet discarded the errant Duodisk or had the drive repaired or replaced at great expense, the fix is to take the two capacitors labelled C29 and C30, found at locations B1 and A1, and cut them off the board. Software protection schemes from PFS and Software Arts seemed to trigger this problem, but other software would also fall victim. On the other hand, if it's not broke - don't fix it!!



Unidisk 3.5 - The newest jewel in disk drives. The small drives seem to be holding up very well. Keep the yellow plastic inserts that are found in the drives when shipped, and use the inserts if you travel with the drives to keep the read/write heads separated. I like the hard plastic disk format that doesn't require a separate envelope. The 3.5's are the wave of the future and I love the idea of storing 800K on a single floppy for AppleWorks!

Since the original version of this chapter was written, I've gotten into a few 3.5 disk drives. Apple has standardized the 3.5 drive so that the internal components (for the most part) will interchange and dealers can provide quicker service with fewer parts. The 3.5 inch drives for the IIe and IIGS have an eject push-button on the right side of the case. The drives are built like a Swiss watch and have so far given excellent service.

800K 3.5" DISK DRIVE COMPATIBILITY

DRIVE	IIe	IIc	IIGS	Mac 128/512/ 512E/Mac Plus Mac SE	Macintosh II
Unidisk 3.5 (white case)	X	X	X		External disk
Apple 3.5 (platinum case)			X	X	drives not
Mac 800K Ext. (beige)				X except 128	supported.

From Apple Technical Support East, "Technical Tidbits", July 31, 1987.

A word of warning about the 3.5 inch floppy disk. It is still subject to damage by heat. Don't let the hard plastic case and metal shutter fool you into thinking that 3.5 inch disks are "bullet-proof". One of the 3.5 drives I explored had been fed a 3.5 inch disk that was warped 3/16ths of an inch from having been left in an automobile in the Florida heat. I still have the disk complete with plier marks which remain from attempts to remove the disk by brute force. After a few minor adjustments, the drive was returned to service and is still working. The moral is take care of the disks!!

Another problem that can aggrevate 3.5" disk users is the metal shutter on some cheap disks which after time will get bent and catch inside the drive. If brute force is used to remove the disk, the danger is catching the tiny (read fragile) read/write head with the bent shutter and destroying the drive. If the floppy can be pushed back in and released either by using a large paper clip or a key stroke combination, the data can still be saved. If the usual tricks do not work, stop and have a technician remove the disk. That's still less expensive that the replacement cost for the whole disk drive. Remove the bent shutter completely, reload the disk and immediately copy the data to another disk. Then discard the unprotected 3.5" disk.

DISK DRIVE SUGGESTIONS

Using some of the Apple Computer Inc. disk diagnostics (the newer Digital Diagnostics versions produced by Dysan are quite sophisticated) the drives have a tolerance of ±26 for their D-speed. Certain software will not load properly with a D-speed variance that great. Using "protected" software, D-speed frequently needs to be in the 0 to -5 range. It is important to check the D-speed every three or four months or every 40 hours of use.

Very erratic D-speed can often be helped by a good cleaning. Clean the read-write arms with alcohol or head cleaner at each cleaning - particularly if the drive happens to be used by a heavy smoker [it can't possibly hurt the drive as much as the smoker - Ed]. Do not use oil anywhere inside the drive - even if it does squeak!! Neither WD40 nor Valvoline 20W50 Racing Oil will cure anything in a disk drive.

There is a carriage limiter adjustment that should be within .020 inches of the cam shaft when the head is on tracks 0 and 34 respectively.

Remember that removing a Disk II or Unidisk interface card while the computer is turned on will blow a chip on the logic board of the disk drive and possibly on the IIe's motherboard AND may cause the drive to erase software it's trying to load.

Poor or improper connections between the disk drives and their interface cards or cables at any point will cause erratic behavior of the drive, possible blown chips on the drive analog board or the interface card and erase the software again.

With two Disk II's connected to the same interface card, a problem with the logic card of the second disk drive (connected to the Drive 2 outlet) can cause the first drive not to load properly. Check each drive independently. If both drives act up, check the interface card by trying a "known good" drive interface card.

The first line of defense with Disk II drives, and the others as well, is a good cleaning and D-speed adjustment. On the rare occasions when cleaning and adjustment does not solve the problem, the component level replacement of one of the four chips on the drive analog card will usually solve the problem.

DEFENSIVE DISK DRIVING

Only about five things can happen to a disk drive.

1. The drive will not boot at all (always an operator aggrevation).
2. The drive will neither read nor write (and it may get aggrevated enough to munch the only copy of your favorite disk).
3. The drive doesn't want to read.
4. The drive doesn't want to write.
5. The drive writes on a protected disk over the only copy of your favorite program.

NOTE - Computer Inspector is a new diagnostic product from MECC (3490 Lexington Ave. North, St. Paul, MN 55126) which provides simple, easy to use checks for teachers to use with Apple II computers. The disk covers 48K Apple][s up to Apple IIGS machines. Check your current MECC catalog for the latest price information.

Power Up (P.O. Box 7600 San Mateo, CA 94403) markets Computer Checkup (advertised price $59.95). According to AppleLink's database, versions of Computer Checkup are still available for the Apple II, II Plus, IIc and IIe. However, the program is not listed in the current Power Up catalog. The program is copy protected, as was XPS Diagnostics, but a card is included with the manual and disk that allows backup copy of the original disk to be purchased for $6.00.

At this point, I usually check the errant disk drive with a copy of MECC's Computer Inspector or Computer Checkup (formerly XPS Diagnostics). Both Computer Inspector and Computer Checkup have a quick drive test procedure. The Computer Checkup manufacturer suggests using a write protect tab on the original diskette and the use of a separate "test diskette." However, the program

will use empty sectors for the read/write tests if a copy of the program disk is used. It is only a minor aggrevation that the disk cannot be backed up by "ordinary means." Just be sure you use a backup copy of the diagnostics (or the so called "test disk") in the event the drive takes a lunch break and decides to eat the data on the diagnostic disk. Computer Inspector requires the use of a "scratch disk" or "test disk."

If the drive fails the test and cleaning the read-write head and setting D-speed fails to correct the problem, you may proceed to go into chip replacement, call your district's repair technicians, or take the drive to the nearest educational dealer.

A few words should be added about D-speed with Computer Checkup. The speed is given in RPM. A speed of 300 is normal. A speed between 299.0 and 301.0 is acceptable according to the information on the disk. It is easy enough to adjust the speed between 299.5 and 300.5 rpm which was the recommended range in the XPS Diagnostics program. If not within that narrower range, I'll usually adjust the D-speed. Take your time making adjustments. The D-speed shown on the monitor is about a second behind the actual adjustment. Finally, an insulated screwdriver is suggested. The eyeglasses screwdriver mentioned in the equipment section works very well for this task.

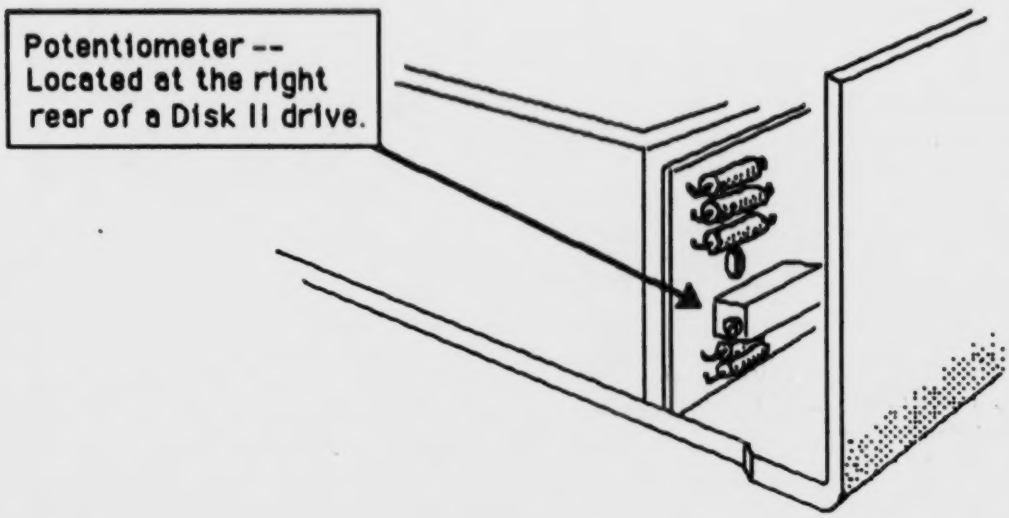


Figure 1

Disk Drive Speed Adjustment Screw

In the case of Computer Inspector, the "acceptable" D-speed is between 306 and 302 and the recommended speed is 299. Who's right? The best advice is use the directions on the disk you are using at the time. Some of the older diagnostics disks used arbitrary values, so follow the directions on the label or in this case, on the screen.

Use a non-metallic adjustment tool if available. The magnetic field developed by a metal tool may influence the adjustment. Adjust to the range specified by the diagnostic disk being used. If in doubt, read the directions - again!

REPAIR OF EARLY ANALOG BOARDS

Since four socketed chips run the Disk II analog circuit board, it doesn't hurt to check for damage. The cover's already off the Disk II anyway. Look for heat damage or traces of smoke on or around the following chips and the 470 microfarad, 6.3 volt capacitor located at C4. (See Figure 2)

74LS125	Located just to the left of center not quite half way up the board. This is a Tri-State Quad Buffer currently priced at about $0.34.
ULN2003A	Located just left of center and 3/4's of the way toward the top of the board. This chip is described as a "Hi-Voltage, Hi-Current Darlington Transistor Array" (a 7 channel input driver) which drives up the price to $0.79.
RCA3146	Located just to the right of center and close to the bottom of the board. Sometimes disguised as an HA1127P. This is a High-Voltage Transistor Array currently priced at about $1.29.
MC3470P	Located near the right edge of the board about half way between the top and bottom of the board. The most expensive chip of the four, this is the "Floppy Disk Read Amp System. It costs approximately $1.95 per chip.

If the capacitor is damaged and the damage is visible (smoked, melted, exploded) replace the capacitor with particular attention to the + and - connections. If the problem took out C4, you can be sure the 74LS125 is also wiped out. Replace the 74LS125 too.

If the analog card is still suspected, connect the bad drive as "Drive 2". Attempt to boot "Drive 1" with a known-good replaceable disk such as DOS 3.3 in drive 1 and a formatted blank scratch disk in Drive 2. If Drive 1 does not boot, replace the following chips in Drive 2's analog card one at a time and again try to boot Drive 1 after each is replaced:

ULN2003
74LS125
RCA3146
MC3470P

If the drive will not read or write and/or destroys data, try the following sequence, again testing after each replacement:

MC3470P
RCA3146
74LS125
ULN2003

If the drive has trouble reading, for example, the disk spins but never stops, or the head does not move, or the disk does not turn at all, replace the ULN2003.

If the drive has trouble writing, try the following sequence of replacements, testing after each:

74LS125
ULN2003
RCA3146

If the drive attempts to recalibrate repeatedly, try replacing the MC3470P.

If the drive writes on a protected disk, replace the 74LS125 and retest.

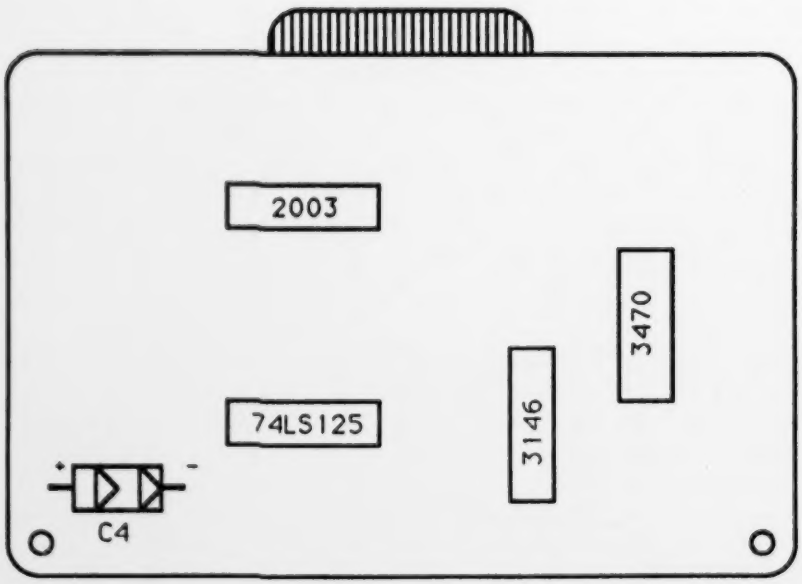


Figure 2

Disk II Analog Board

If you've cleaned the drive, set the D-speed, replaced all four chips and the doggone drive still doesn't work, chances are there is serious damage to the analog card or the interface card and it's time to call for the third level of defense -- the maintenance budget! Replace the original chips and send it to the district repair shop with a work order request. If the drive is your own, send it to your local dealer with money.

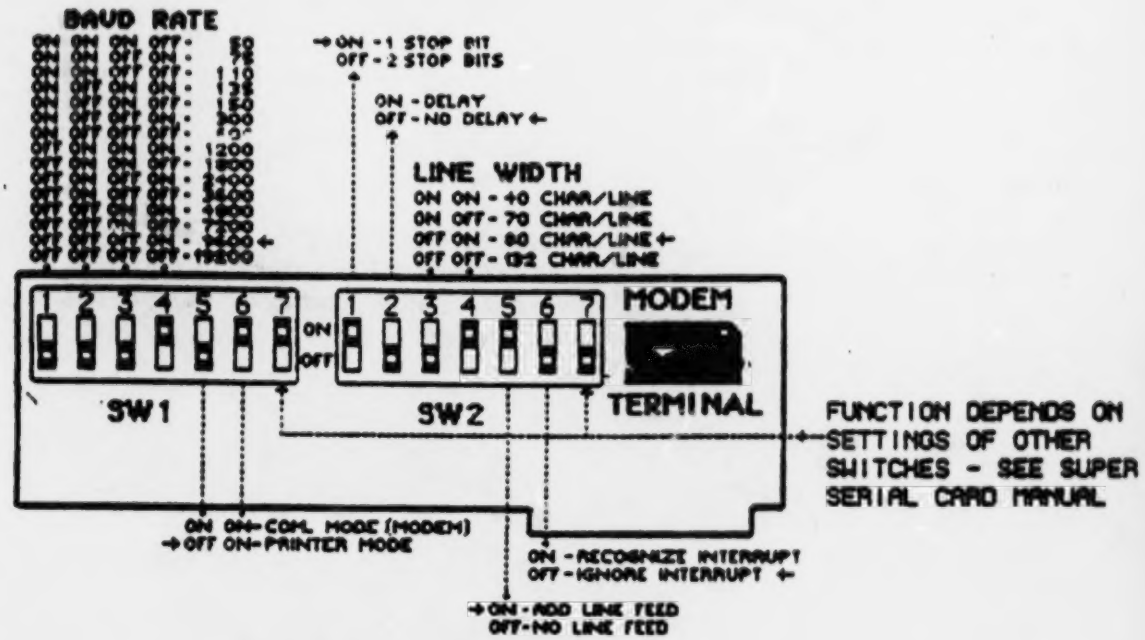
Luckily, the most common failures seem to be the 74LS125, RCA3146, and the MC3470P. All of the chips and the capacitor are available through many suppliers and mail order houses which advertise in microcomputer magazines. One such source is:

JDR Microdevices
110 Knowles Drive
Los Gatos, CA 95030

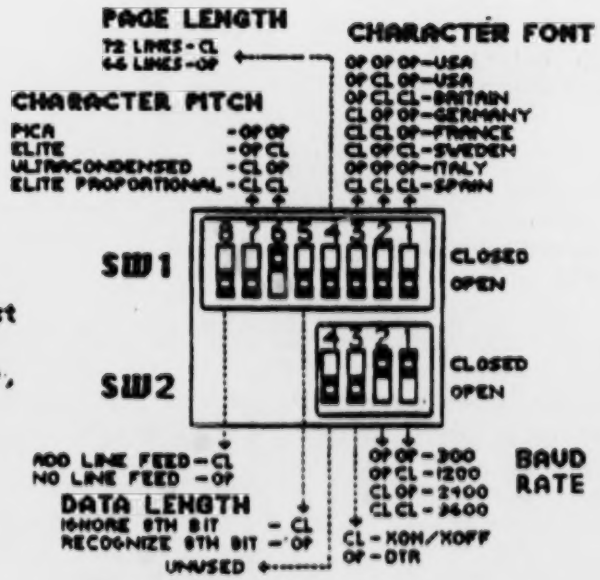
PLEASE PASS THE DIP

The following pages show the suggested dip switch settings for some of the various apple computer/printer configurations used in Polk County. If you have a piece of equipment not shown, first check your manuals, then check with the district contact person or your local Apple dealer.

DIP SWITCH FUNCTIONS #1


BAUD RATE
ON ON ON OFF - 50
ON ON OFF ON - 75
ON ON OFF OFF - 110
ON OFF ON ON - 134.5
ON OFF ON OFF - 150
ON OFF OFF ON - 300
ON OFF OFF OFF - 600
OFF ON ON ON - 1200
OFF ON ON OFF - 1800
OFF ON OFF ON - 2400
OFF ON OFF OFF - 3600
OFF OFF ON ON - 4800
OFF OFF ON OFF - 7200
OFF OFF OFF ON - 9600
OFF OFF OFF OFF - 19200
→ON - 1 STOP BIT
OFF - 2 STOP BITS
ON - DELAY
OFF - NO DELAY ←
LINE WIDTH
ON ON - 40 CHAR/LINE
ON OFF - 72 CHAR/LINE
OFF ON - 80 CHAR/LINE ←
OFF OFF - 132 CHAR/LINE
1 2 3 4 5 6 7
ON
OFF
SW1
SW2
MODEM
TERMINAL
FUNCTION DEPENDS ON SETTINGS OF OTHER SWITCHES - SEE SUPER SERIAL CARD MANUAL
ON ON←COM. MODE (MODEM)
→OFF ON-PRINTER MODE
ON - RECOGNIZE INTERRUPT
OFF - IGNORE INTERRUPT ←
→ON - ADD LINE FEED
OFF - NO LINE FEED

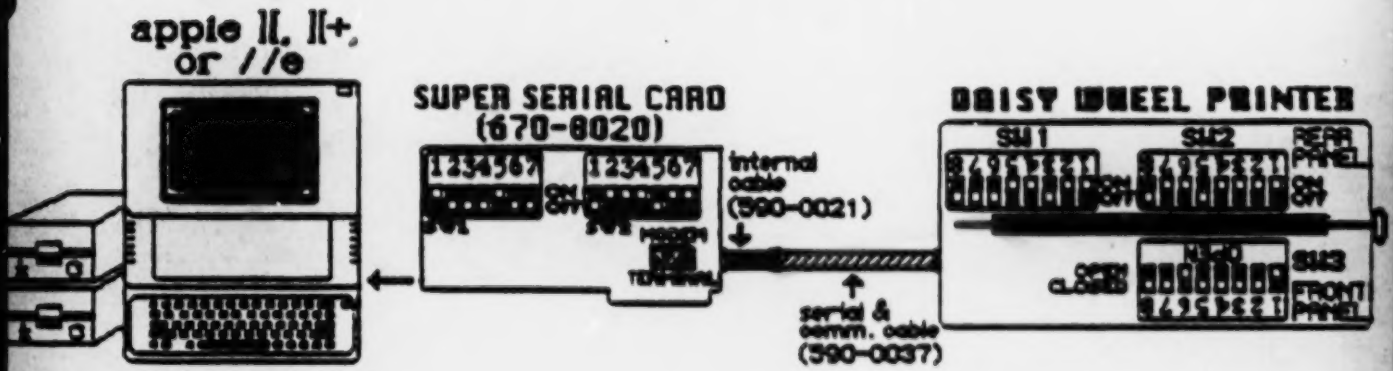
Super Serial Card

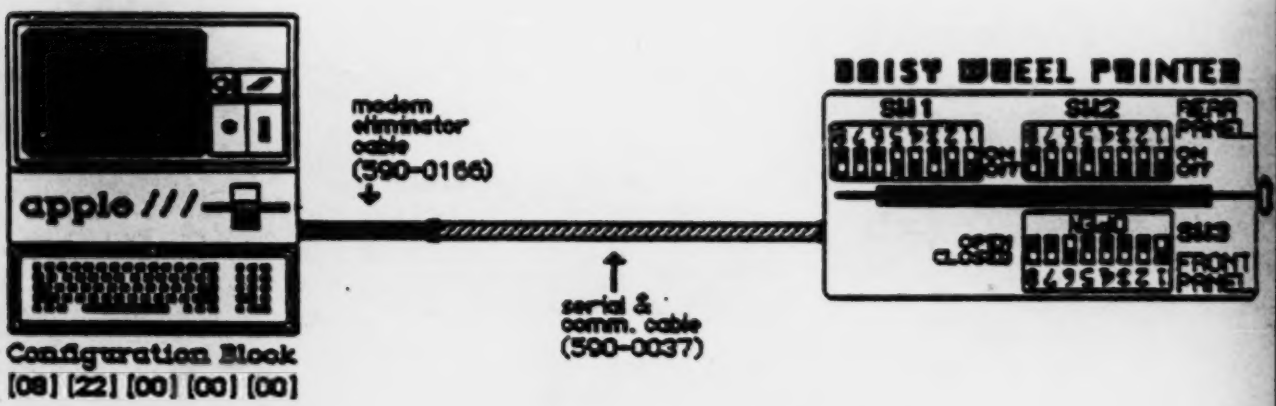


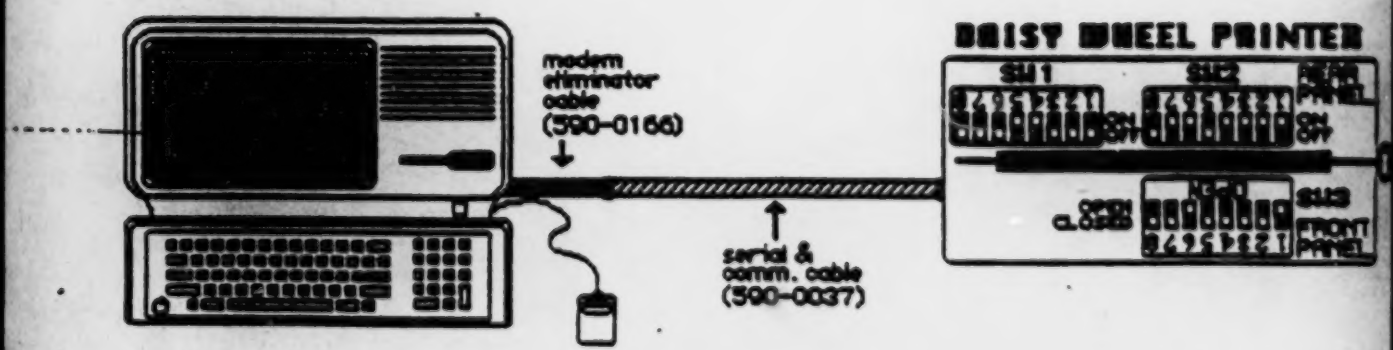
switches are shown in most commonly used positions (exception: For Apple //e, Imagewriter switch 1-5 should be set to closed position)

Imagewriter Printer

Daisy Wheel Printer Configuration

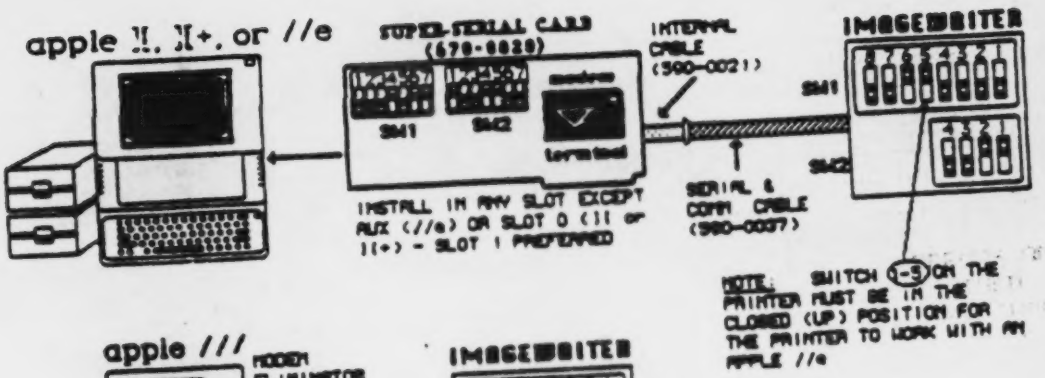


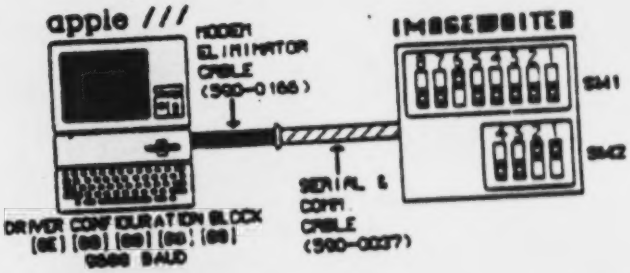


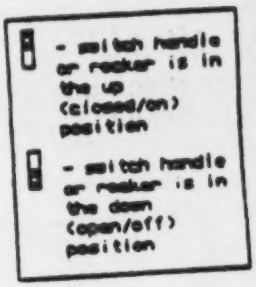


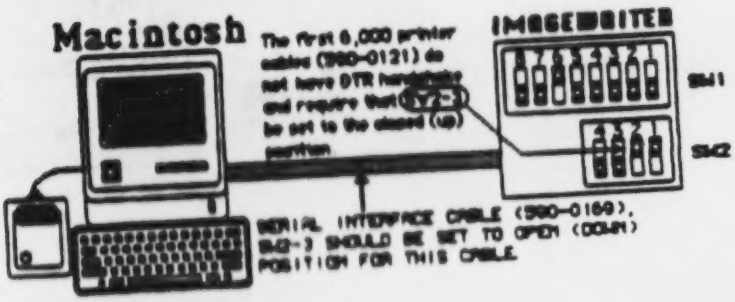
- Switch handle is in up position or top half of rocker switch is depressed
- Switch handle is in down position or bottom half of rocker switch is depressed

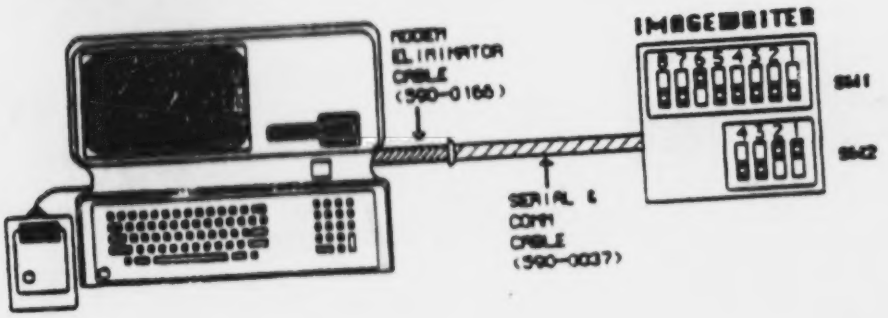
Imagewriter Configuration


apple II, II+, or //e
SUPER SERIAL CARD
(670-0020)
INTERFACE CABLE
(590-0021)
IMAGEWRITER
SW1
SW2
INSTALL IN ANY SLOT EXCEPT AUX (//e) OR SLOT 0 (II or II+) - SLOT 1 PREFERRED
SERIAL & COMM CABLE
(590-0037)
NOTE: SWITCH 1-5 ON THE PRINTER MUST BE IN THE CLOSED (UP) POSITION FOR THE PRINTER TO WORK WITH AN APPLE //e



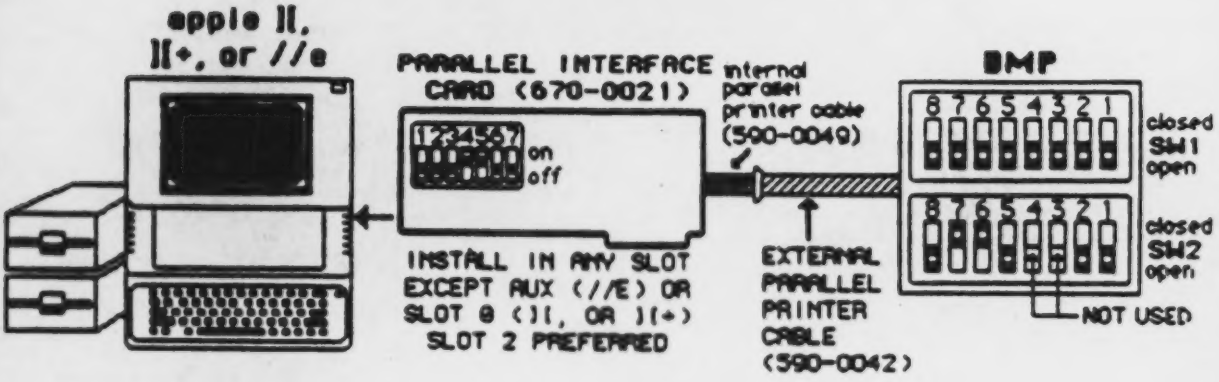


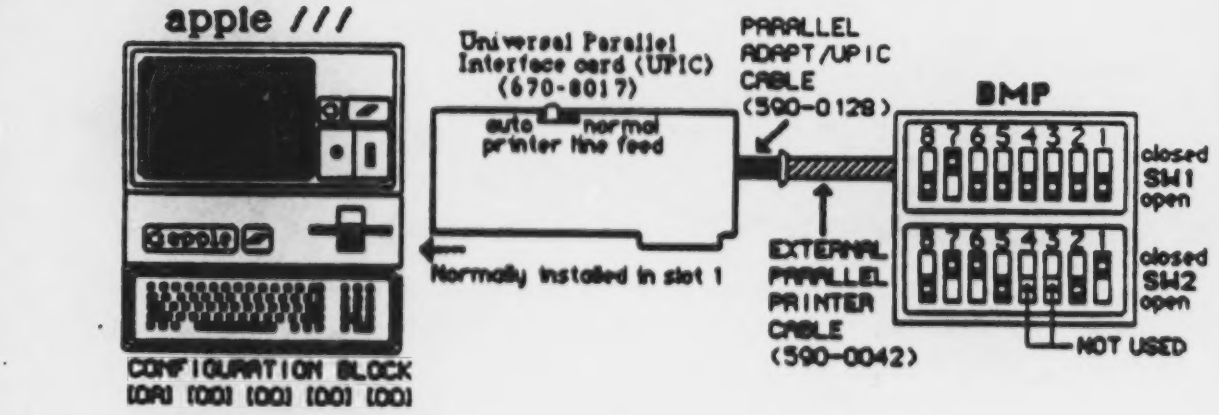

Macintosh
The first 8,000 printer cables (590-0121) do not have DTR handshake and require that SW2-3 be set to the closed (up) position
IMAGEWRITER
SW1
SW2
SERIAL INTERFACE CABLE (590-0169), SW2-3 SHOULD BE SET TO OPEN (DOWN) POSITION FOR THIS CABLE

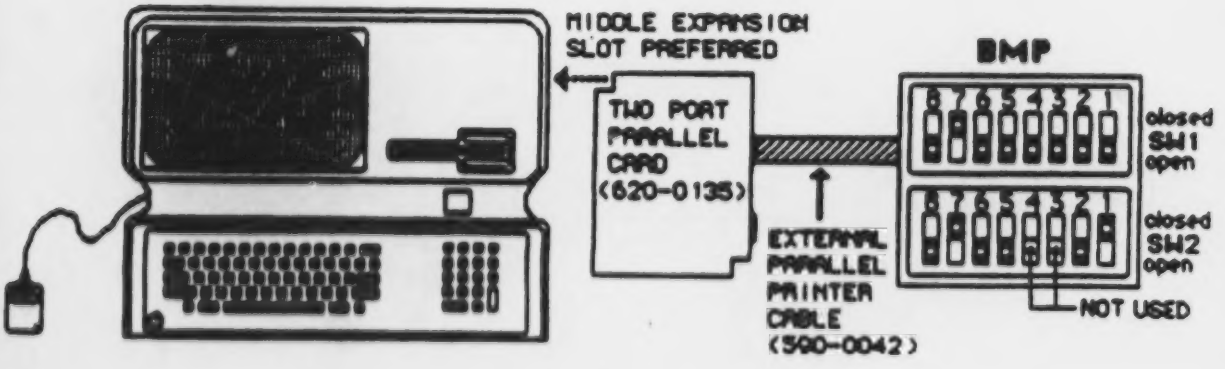


DMP

DOT MATRIX PRINTER CONFIGURATION







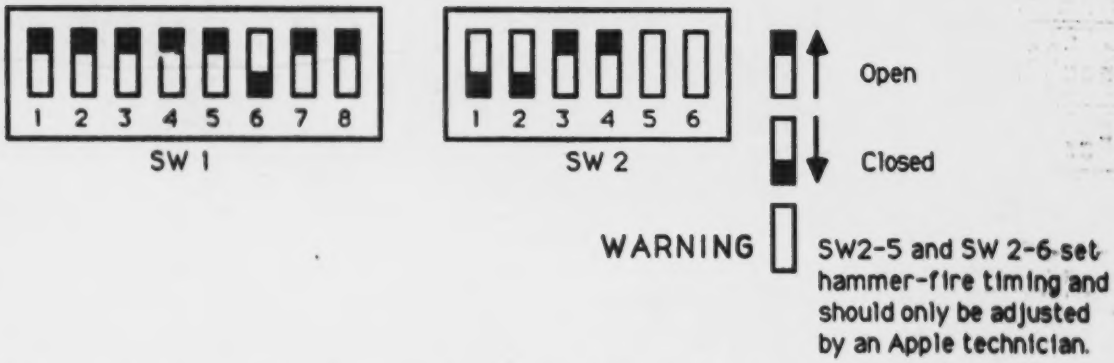
- SWITCH HANDLE OR ROCKER IS IN UP (CLOSED OR ON) POSITION

- SWITCH HANDLE OR ROCKER IS IN DOWN (OPEN OR OFF) POSITION

2/17/84

ImageWriter II Dip Switch Settings

The switch settings shown below are the standard, "as delivered" settings for the ImageWriter II.

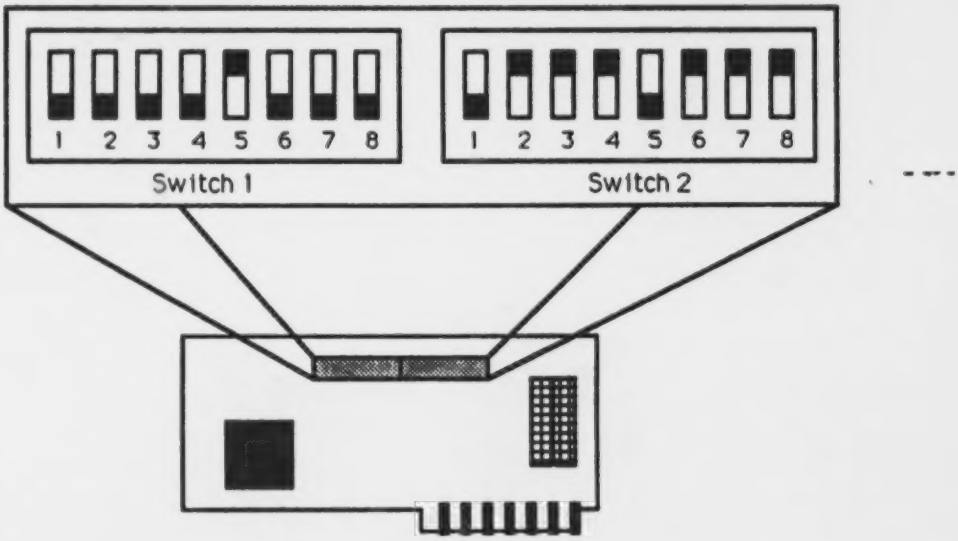

1 2 3 4 5 6 7 8
SW 1
1 2 3 4 5 6
SW 2
Open
Closed
WARNING
SW2-5 and SW 2-6 set hammer-fire timing and should only be adjusted by an Apple technician.

Information regarding the switches may be found in the Owner's Manual on pages:

p. 69-70	Standard Switch Settings
p. 86-87	Appendix C - Alternate Switch Settings

Switch Settings for Microtech Serial Card

Several Polk County Schools have Microtech serial cards instead of Super Serial Cards. The settings shown below are suggested for use with an ImageWriter printer.



Card is labeled "SV266" and "SLOTWARE by MICROTECH".

APPLE IIc COMPUTERS

The little Apple IIc will do everything the normal IIe will do in a smaller package. The drawback to the IIc is adding extra interface cards. For example, a IIc with a second disk drive, new color monitor, and an ImageWriter II printer is a super rig for most applications. However, don't plan to upgrade the IIc with a MIDI music interface, or add a coprocessor card with a newer, faster CPU chip. In fact, leave the inside work to an Apple technician. It's crowded inside the little case.

The thin disk drive built into the IIc allows external adjustment and use of a cleaning disk is suggested to clean the read-write heads.

When the IIc was first released, some IIe programs would not run on the IIc. For the most part, the current IIe enhanced and IIc programs are running fine. If you happen to encounter a program that will not run correctly on your computer, check the box or the user's manual. The documentation should clearly indicate if the program is for a specific computer, IIe or IIc. Most of the older II+ programs will run on anything that electrically looks like an Apple.

APPLE IIGS COMPUTERS

This is the computer that looks to be the successor to the IIe. This is being written after setting up only a few of the machines, but I at least read some of the manual. A couple of observations are in order.

1. The IIGS carries a lot of graphics as "overhead" and loads from 3.5" or 5.25" disks just as always. Therefore, it appears to be slow [It is slow! - Ed.] but considering all the color graphics, the little CPU is working hard. It works even better from an HD20SC and supports AppleTalk networking.

2. The sound chip (15 voices) has to be heard. It may take a music major or a foreign language teacher to truly understand the potential.

3. Many of the features that used to require extra cards are built into the IIGS motherboard. That means that slots are available for video boards to capture images from a TV camera, or MIDI boards to load keyboard input, or CD ROM when that technology catches up. There is room for expansion. There is even room and a connector for (gasp!) a fan.

4. From what I've seen, it appears to be a well made computer and thought was given to making it easy to repair. What we've found out so far....

Installation and Set Up The installation is easy if left to the "installing dealer," but in the spirit of adventure, only a few things present a challenge to the new owner. For example, which is the "boot drive"? The school solution seems to be hook the 3.5" drive to the computer, and daisy-chain the 5.25" drive into the

back of the smaller drive. The control panel program allows a set up to scan the drives on start-up. The IIGS seems to boot from almost any combination I've tried.

The Control Panel The manual directs the new owner to hold down the option key and turn on the computer to access the control program. I never did get that method to work. The friendly technician at the local Apple store provided the first clue. Hold down the Command (Open Apple) and the Control Keys, then press Escape. Now you can get to the Control Program to adjust the sound levels of the Bose speakers!

According to Apple Service Training's symptom chart, the control panel seems to be the key to proper setup and operation of the IIGS. If the display is "fuzzy" with a good monitor, check the control panel video setting. If the computer won't boot from a known-good disk drive, check the control panel settings for correct slot assignments. If the keyboard seems to print characters on the screen known only to a foreign exchange student, check the control panel for the correct language setting. The modem doesn't work? The printer hasn't printed? Check the control panel for the proper settings. No sound - too much sound? Right! Check the control panel for volume level and tone. Are your programs crashing faster than Flight Simulator? Check the control panel for speed - normal or fast.

The control panel also adjusts the color for AppleWorks if the RGB color monitor is used. Experiment until you find the combination you like.

While on the subject of the control panel, you can still use your old printer and cable with the new IIGS if you use your old super serial card. Put the card in slot 1 just as always. Twist the metal spring lock to uncover an opening for the cable connector, and install the ribbon cable and connector. Don't test the printer just yet. The computer still thinks it's working off the serial connector on the motherboard until you change the control program. Enter the Control Panel (as above) and set slot 1 for "your card". (No check mark appears to be normal when "your card" is selected.) Then, power off, wait a few seconds, and turn the computer back on. Now everything should work with your old card, cable, and printer.

Why turn the computer off? The control panel apparently resets a static RAM chip which then acts just like a dip switch when the computer is turned on. The only time the computer reads the setting is when it is turned on.

I've often wanted to know who was responsible for some of the things that have happened in education. I thought it was evidence of pride in their craftsmanship that the names of the developers of the Macintosh are still embossed on the inside of the computer's case. The IIGS has a similar trick. Turn on the IIGS with no disk in the drive. After the "Check Startup Device" message appears, press the Command, Option, Control and N keys to see the names of the developers.

AppleWorks 2.0 is set to load into the available RAM. If you order a RAM card, read and follow the directions furnished. The trick will be to remember where you put the jumpers that are furnished with an "unpopulated" card on the day you decide to add the extra RAM chips needed to fill up the sockets on the card. HINT - Save and mark the plastic bag containing the jumpers.

The correct IIGS RAM chips are 150ns 256K X 1 bit chips but they must have CAS before RAS refresh. That really translates that some after market or "third party" 256K chips don't do the "refresh" correctly and your memory upgrade won't work. The following are RAM chips that are compatible with the IIGS:

Fijitsu America, Inc.	MB81256-15P
Hitachi	HM50256P-15
Micron Technology	MT1259-15
Mitsubishi Electronics	M5M4256AP-15
Motorola	MCM6256BP-15
NEC Microcomputers, Inc.	UPD41256C-15
OKI Semiconductor	M41256-15
Samsung	KM41256AP-15
Texas Instruments	TMS4256-15NL
Toshiba America	TMM41256P-15

Check with your friendly Apple technician to be sure what chips will work. (You are maintaining cordial relations with your local dealer aren't you....?)

Also check to see if the jumpers are installed on the memory expansion card. The jumpers are marked "J1" and "J2". No jumpers are required for the 256K configuration. J2 must be installed to see 512K on the card. J1 and J2 are required for the computer to see 1MB of memory.
(Thanks and another tip of my Apple coffee cup to "Tech Tidbits" and Apple Computer, Inc. for the information.)

MONITORING THE ACTION

Apple monitors on the whole have been very reliable. On rare occasions the cable that connects the computer and the monitor can cause teachers a small amount of grief.

The older monochrome Monitor II's have a 0.5 amp fuse soldered into the small vertical circuit board located on the left side of the monitor chassis. On the newer Monitor II's the fuse is held by clips. If you have a Monitor II that suddenly drops dead, you may want to check the fuse. If the thin wire that runs down the center of the glass tube has melted into two pieces or appears to have broken then the fuse is open.

However, to check the fuse it is necessary to open the case. Read once again the safety precautions in the general section of this manual. If you must proceed, chase away the surrounding students. Then unplug the monitor (both power and signal cord). Third, remove the four screws from the bottom of the monitor and

two from the back. Carefully slide the case toward the rear. On some of the older monitors, the power cord will not slide through the hole in the case. Since the case is open, discharge the anode with a long screwdriver connected to the back of the chassis with a wire and alligator clips. Locate the filter circuit board on the left side of the chassis.

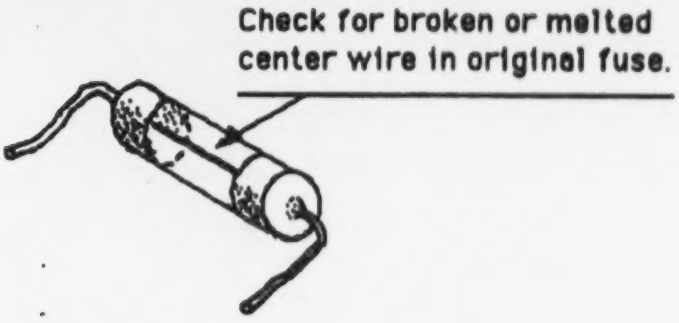


Figure 3

Pigtail Fuse

Instead of removing the filter board and unsoldering the fuse, several technicians have mentioned using a "pigtail fuse", a fuse with short wires already soldered to each end (See Figure 3). The new fuse is often added in parallel and the new fuse wires soldered to the old fuse wires. It works very well thank you.

The cables occasionally get loose or a student will loosen the cable at the monitor or the computer end. The monitor begins to look out of focus and colors fade. Before panic sets in, check the connections. If the connector is loose, the outer portion of the connector may be gently tightened with a pair of pliers.

NOTE -- Radio Shack's 36" Shielded HiFi Cable (Part # 42-2366 Cost: $1.89) which is a shielded wire with an RCA Phono Plug at both ends can be substituted for Apple Monitor II cable (Part # 590-0025 Cost: $8.00). The Apple supplied cable is well engineered. The Radio Shack part will work.

Before anyone declares the monitor dead, also check to see if the brightness and other controls have been twisted out of normal range. The monochrome controls are on the back panel of the monochrome monitor. The color monitor controls are beneath a front panel.

NOTE - The new color monitors for the Apple IIe and IIc have a switch that allows them to use color for 40 column programs and monochrome for 80 column text and spreadsheets. The owners of the older composite color monitors are not so lucky.

THE KEY COMPONENT

As an adult, I have yet to figure out how to break the top off an Apple II or IIe key. I have seen the results of student contact. (I sometimes wish I could do the same to the little malcontent's fingers). When and if it happens, save the key cap. The individual key mechanism can be replaced. The key caps are only available in sets. If glue or epoxy is used in an attempt to patch the key, the stub of the key stem may be glued into the cap, and the eventual permanent repair will require a new key cap.

MACINTOSH and MACINTOSH Plus

The Macintosh was originally thought to be a "closed system". The case is not easily opened. A very long Torx driver is considered the weapon of choice if you decide to attack a Mac. Remember also that all the warnings concerning exposure to the 12,000 volt anode and transformer apply. The procedure should not be undertaken lightly and you have been warned! If you decide to disregard the warnings, follow the directions supplied with the add-on product very carefully and don't forget the Torx screw underneath the lid to the battery.

The July, 1988 edition of MACazine contained two maintenance articles which were considered excellent. "Macintosh Repair and Maintenance" by Larry Pina and "Caring for Your ImageWriter" by Scott Brainard. The magazine may still be found in a library.

The newer small Macs have 128K ROMs (two versions) instead of the older model's 64K ROMs. If you have a Mac Plus with the older 128K ROMs, the major difference is that a hard disk drive connected to the SCSI port should be turned on before turning on the Mac Plus. With the newer ROM versions, it's not as important. Yet, I still turn on the hard drive before the computer. Old habits are hard to break.

The Mac 400K drives and 800K drives lack the eject push button found on the Apple IIGS. If a diskette gets stuck or doesn't fully eject, do not use force. Attempt to eject the disk as follows:

1. Hold down the "Shift" and "Command" keys and press "1" for the internal drive, or "2" for the external drive.
2. Pull down the "File" menu and select "Eject".
3. Insert a large paper clip in the pin hole to the right of the disk slot. Push straight in to unlatch the disk.

Generally, it is considered bad form to:

1. **Pull on the stuck disk with "Vise-grip" pliers.**
2. **Hold the Mac with the monitor faced down and shake violently! (It's been done, folks!)**

Besides, neither of those methods usually work anyway. Check the section on 3.5" disk drives on page A-5 for additional suggestions on bent shutters.

Keep the number of disk labels to no more than three. If you reuse disks often, and at the original prices all of us did, gently peel the old labels off. The cement usually will rub off the plastic with thumb pressure. A damp (not dripping wet) swab with head cleaner will soften the stubborn spots.

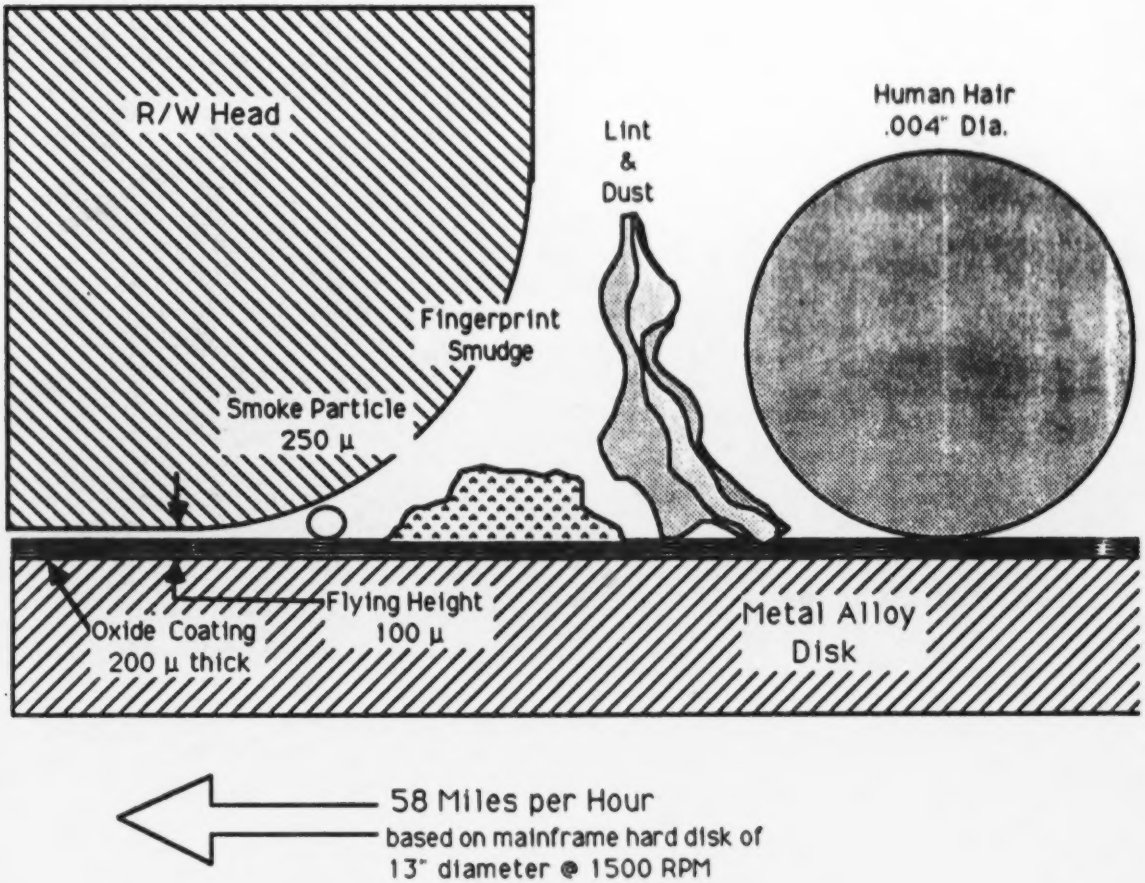


Figure 4

The Relation of Disk Head, Disk and Contaminants (based on an older model mainframe disk drive)

One of the flaws in the early Macs was located on the power supply board. The early type board, used in 128K and 512K Macs, contained a flyback transformer that was less than reliable. A quick check can be made if your early model screen develops the "jitters or flickers." Open the case and without touching the wire, the insulators, or the transformer (remember the shocking earlier descriptions), check the single thick wire running from the side of the CRT to the vertical board on the right side of the Mac. If the suction cup type insulator on the CRT is black, the flyback transformer is one of the early "suspect" types. If the suction cup is clear plastic, check the other end of the thick wire. If the connector at the transformer has a white base, the transformer may still be one of the weaker varieties. If your flyback transformer matches neither of these descriptions, your board should be one of the newer ones. Some service shops (not authorized dealers) can replace just the transformer. Authorized dealers are supposed to return the entire analog board to Apple for replacement and testing.

If you decide to upgrade your early Mac 512E with more memory and a SCSI port, several third party add-on boards are available. Some of the very early 512Es were just a little different than later 512Es, a fact uncovered while adding a Dove 1MB upgrade. As soon as the proper additional 47 ohm resistor was added and the voltage adjusted to a slightly different setting, all worked well. The moral of the story is: If you really followed the directions, done everything the manufacturer said to do, and the darn thing doesn't work, then call the manufacturer's tech support. You can waste several days, like I did, collecting enough system bombs for a 4th of July party, and one expert technician, a two minute call and five minutes of work solved the problem. Sometimes it's easier <u>not</u> to figure it out yourself!

The Dove 1MB upgrade board and the Dove SCSI port, by the way, have been as solid as a Georgia pine stump ever since.

MACINTOSH SE AND MACINTOSH II

The SE is an intermediate machine. It is similar to the Mac Plus and lesser machines. The only thing that is the same is the monitor tube! It's a faster machine with 256K ROM, 80 watt power supply, an internal fan, and a connector for an internal expansion board. Internal hard disk drives are popular. It's the keyboard that is now an option. The standard keyboard and a new IBM style keyboard with F-keys are both available.

The separate hard disk units, such as the HD20s were usually different enough to have an air of mystery about them. The "resident techie" could tell the new owner two or three horror stories about hard disk drive failures and the loss of all data and the poor owner would treat the HD20 with reverence and respect, faithfully backing up data at frequent intervals. The HD20 was as tough as a Patton tank, but respect and appropriate care were important. Now the little Mac has a 20 megabyte hard disk built into the case, and owners are swinging the computer at the end of their elongated arms up and down the hall. No respect at all!!!

A word of caution to all SE owners. Check out the hard disk diagram in this section. That diagram is based on old technology, but tolerances are still very close. Hard disks have improved since the district's original Corvus with five megabytes of storage, but things can still go wrong. Care should include the following:

1. Never move the Macintosh SE around during operation - especially while the little red light is blinking furiously. Never bump the SE during shut down. A jolt could cause one of the read/write heads to crash into the plated media on the hard disk.

2. Never drop the SE. Even a one or two inch free fall onto a hard surface could damage the hard disk or even crack the thin glass portion of the CRT.

MACINTOSH PRINTERS

Macintosh computers use a variety of cable arrangements to connect to the outside world of printers. The standard nine-pin or D9 type cable was used on the early 128K and 512K Macs. Mac Plus and SE models use an eight pin or P8 cable connector to modems and ImageWriters. The LaserWriter and LaserWriter Plus use an Appletalk Network adapter usually connected to the printer port.

A Macintosh will support both an ImageWriter and a LaserPrinter without an A-B switch. Just connect the AppleTalk cable and LaserWriter to the printer port where it's expected. Then connect the ImageWriter to the modem port. Be sure to select the telephone icon when using the Chooser to select the ImageWriter printer. Of course, an AppleTalk card can be added to the ImageWriter II and LQ printers and they can also be a shared resource on an AppleTalk network.

IMAGEWRITER I AND IMAGEWRITER II

The ImageWriter II uses the same ribbon as the older ImageWriters for black and white printing, but four color ribbons are available, if somewhat expensive. The sum total of negative experiences is shown below:

1. The cover has a magnet that prevents the printer from printing in the presence of children's fingers. Handy thing to have in a classroom. However, the printer will not work without the cover being correctly positioned. If your printer suddenly doesn't print, check the cover.

2. The new "pusher" tractor rolls the crease in the paper under the two black rollers above the print head just as the top line on the page is printing. The characters may be shorter than normal. Some continuous paper seems worse about that trick than others. I have used a few "#2 Boston Clips" to pull on the leading sheet of paper when it was a problem.

3. I have not yet found a printer proof 1" x 4" address label. If the printer driver or the software (or the user) attemps to back up to save a label or two, the user risks peeling a label off inside the printer. The last label I removed was located directly under the large rubber platen and glued to the smooth black plastic guides. It took about an hour and a half worth of aggrevation and several cc's of alcohol to remove the glue from the guides so that paper would again feed through the printer.

NOTE - Microsoft Works 1.1 and later versions will have a modified printer driver to keep the ImageWriter from rolling labels backwards as it starts to print.

THE "LQ" DOES NOT STAND FOR "LOW QUALITY"!

There are some jobs that fall between the ImageWriter II and the LaserWriter. Financal wizards with large spreadsheets that are difficult to reduce in size, or offices that can't quite afford the LaserWriter were the original target for IW LQ sales. I still like the speed and what it can do with graphics even with the limited fonts available. OK, so the 27 pins hitting the paper at the speed the LQ uses does sound like a canvas sail being ripped!

While the LQ will print from an ImageWriter printer driver, better results are obtained with the ImageWriter LQ drivers in the system file. The printer is shipped with the proper drivers and the font disks which allow the LQ to print in best quality. Since the 27 pin LQ printhead is organized in three rows of nine pins, the best printing occurs with a font three times larger than the screen font. For example, the screen shows 12 point Helvetica but for "best quality" printing, the LQ will use 36 point Helvetica reduced to 1/3rd its normal size. The short side of this is that LQ users should install and use the LQ fonts supplied with the printer.

This is a sample of 12 point Helvetica. This size type would appear on the screen during normal use.

This is a sample of 24 point Helvetica. This is the size that would be reduced to 12 point type using "best quality" on an ImageWriter.

This is a sample of 36 point Helvetica. This is the size that would be reduced to 12 point type using "best quality" on an ImageWriter LQ.

The first negative most users noticed was the top area of the ImageWriter LQ ribbon would appear tattered and worn while the rest of the ribbon appeared to be almost unused. Bands two, three and four were unused for the most part.

According to Apple, when the LQ is first turned on, the ribbon position starts with the top band. Then the second page of a multipage document will print on the second band. The next page will print on the third band as the printer attempts to eventually distribute the printing on all four areas of the ribbon. The flaw in that scenario is that people turn printers off. It may be time to go home, or those of us that were trained on the early printers to turn off the printer so as not to damage the stepper motor as we adjusted paper position, but there are many reasons to turn printers off. The problem is that turning the LQ off and back on also resets the "top of form" position.

The difference is when the LQ is turned off, the printer starts over at band one again. The "workaround" suggested is to leave the printer "on". I'm not quite sure what to do about Florida thunderstorms or the dedicated custodian who sees the little green lights glowing faithfully in the dark, and finds the "off" switch, but the suggestion seems to be leave the printer on as much as possible to equalize the use of the ribbon.

One other possibility according to the folks at Apple, is a tab on the end of the ribbon cartridge closest to the switch panel. If the tab has broken off or is loose, the printer will think a color ribbon is being used and print black from the top band.

LASERWRITER AND LASERWRITER PLUS

If a known-good printer does not print, first check the cables at both ends of the connection. And do tighten the thumb screws on the D9's. Then check the control panel and chooser options under the Apple menu. In the case of the LaserWriter, the computer has to be told which Laser-Writer to use. The LaserWriter and LaserWriter Prep program (usually shown by icon) must be on the user's disk or on the hard disk - but only once. The printer drivers are usually stored in the system folder.

Another hint when starting to use a LaserWriter. If several computers are using the same LaserWriter, and one user updates the system file or LaserWriter file, all the users on that Appletalk network should update their files as well. Different printer drivers will confuse the LaserWriter and it may be necessary to turn off the LaserWriter and perform another start-up again. If the update has an "install" program, use it. Updates can normally be accomplished by "dragging" and copying, but the install programs sometimes update the older system files as well.

LaserWriters use "Postscript" fonts. Fonts that can be quickly enlarged or reduced and remain smooth. "Bit-mapped" fonts sometimes appear jagged or rough when the size is changed. Fonts originally supplied with the Mac, such as Geneva, New York, and Monaco are bit-mapped. Helvetica, Times, and Courier are "built-in" to the LaserWriter. The bit-mapped fonts must be downloaded from the computer before being printed and may slow the printer down by a factor of three or four times the usual rate.

As a bit of information, until the SE and Mac II, the LaserWriter was the smartest computer in Apple's inventory. The computer section sat above the Canon photocopier "engine" and circuit board. The LaserWriter had more ROM and RAM than a normal Mac Plus and had its own 68000 CPU. Still, if the user sends a complicated drawing with several changes of font, the printer will take longer to process and print the page. The story is told of a single MacDraw page with over 30 "layers" of drawings which took three hours and forty minutes to completely print.

The LaserWriter has a cartridge that contains all the toner powder and the photosensitive drum. If the toner cartridge is replaced, don't forget to pull the sealing tape tab before you call support to come out and fix the LaserWriter. If the LaserWriter is moved, remove the toner cartridge before the move. It's easier than cleaning up the inside of a LaserWriter after the powder spills.

If the copy is streaked or too light, remove the cartridge and rock the cartridge gently back and forth to evenly distribute the powder inside the reservoir. Reinstall the cartridge. If still lighter than normal, print a dozen or so copies. Some cartridges need to be "broken-in". Finally, there is a print density adjustment on the back of the machine. Normally, it will NOT need adjustment.

If you replace a toner cartridge, be sure to replace the cleaning pad furnished with the cartridge. The pad is located under the green cover. Observe the high temperature warnings. The fuser area near the cleaning pad gets very hot during heavy use.

While on the subject of toner cartridges, the LaserWriter has several "counters" built into the system. The counter in a toner cartridge is a mechanical counter that is based on 3,000 "average" copies. If only double spaced dissertations are printed, the cartridge will last longer than if a large quantity of dense art work is published. The official word is, "Don't replace the toner cartridge until the toner quits." Some of the toner cartridges in our office have lasted for over 6,000 copies.

Another question usually asked is if the "test print" can be eliminated to save paper. The test print makes sure the printer is working properly and at the going rate for a ream of paper, it's a cheap test. To a confirmed Apple techie, the test print confirms the printer is switched to "Appletalk", the ROM version is indicated, and the number of prints on the circuit board presently installed in the machine is shown. The answer to the question is, "Yes, the test print routine can be defeated by some programs which have been printed in magazines, but some of

the published programs risk damage to the $2000.00 I/O board which is not a warranty or AppleCare repair." In other words, paper's cheap!

If you absolutely cannot tolerate the waste of a single sheet of paper, pull the paper cassette out about an inch, turn on the LaserWriter and wait about five minutes, then push the paper cassette back into its proper position. No software is required, no hardware modifications are required, and a test print is still available if needed. Thanks to Apple Technical Support East - Tech Tidbits 8/28/87 for the hint!

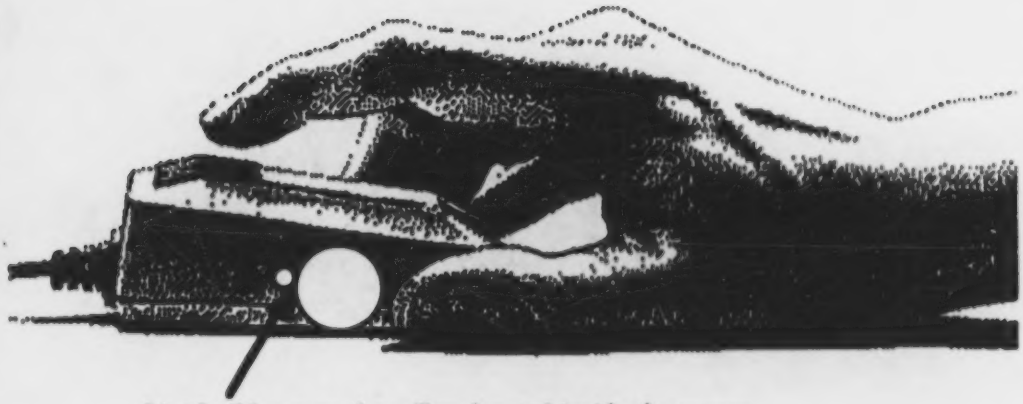
Printing a bit mapped image from MacPaint, FullPaint, or SuperPaint can be a problem since they often need to be reduced or enlarged to fit surrounding text. Cynthia Harriman and Jack Hodgson writing in Macintosh Today suggest users do the scaling after pasting the full-sized image into a drawing program such as MacDraw, or into the drawing layer of SuperPaint or even the word processor itself. Scaling works better in the drawing software because the picture is "remembered" and transmitted to the LaserWriter as a full size image with instructions for the LaserWriter to scale it, which improves the quality of the image in the final print.

Even further, Harriman and Hodgson suggest the appearance of a bit mapped image (MacPaint) on a LaserWriter will be improved if the document is printed at 96% instead of full size. The 72 dots per inch on the Macintosh screen line up better with the 300 dots per inch of the LaserWriter at the following reductions: 96, 72 and 48 percent.
(From "Macintosh Advisor" by Cynthia Harriman and Jack Hodgson, Macintosh Today, June 6, 1988, p. 28, and June 13, 1988, p. 24)

ON THE SUBJECT OF MICE

The debate over the increase in the number of mice on desktops has recently been expanded with the development of alternatives to the conventional single button mouse. I've seen optical mice that are limited to use on a special gridded pad. Track balls have been seen more frequently. Recently, an advertisement has been spotted that allows a user to write on a special pad instead of typing. The pad eliminates both mouse and keyboard.

Before spending good money to replace a "lumpy" mouse, attempt a cleaning. Kits are available to remove the lint that mice accumulate on the internal rollers. The lint buildup is not even and makes the mouse rough and "lumpy." Twist the dark ring on the bottom of the mouse to the left. Alcohol on a damp swab may be used to soften the lint, and any remaining residue may be scraped gently with a fingernail or the other end of the swab to dislodge stubborn particles. Clear the chamber of any remaining dust particles, reassemble the mouse and twist the ring to the right to lock everything back into place.



Lint builds up on the rollers located inside the mouse.
Periodic cleaning will keep the "mouse action" smooth.

Figure 5

Apple Mouse Cleaning

With the newer versions of the control panel, adjust the mouse for speed and area covered. The mouse can be set up to cover a lot of the screen rapidly. It can also be "slowed down" to make it easier for young children to use. Experiment with the control panel setting until you've found a comfortable setting. For example, I can move my mouse from full left to full right or from top of the screen to the bottom without picking up my hand. That setting may be "too fast" for some users.

NOTES

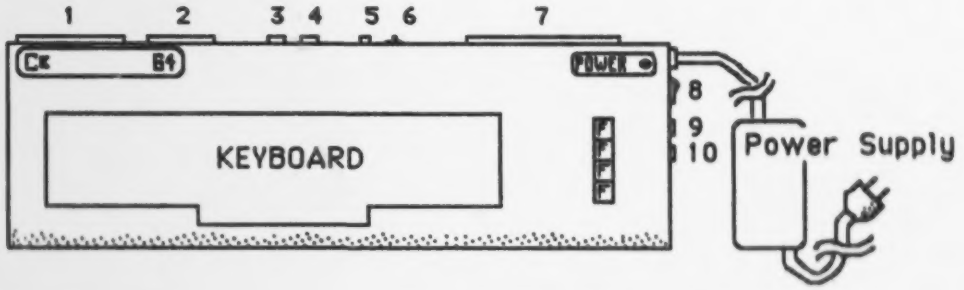
COMMODORE COMPUTERS

by

Ward Hurst[1]

Commodore C64 CPU's

The Commodore 64 power supply is the most common offender of an apparently malfunctioning computer. A bad power supply can ruin the mother board of the 64. If your 64 is not working properly, disconnect everything and reconnect the CPU/Keyboard to a known good power supply. If it then works, and did not work on the old power supply, destroy the old power supply (it is not repairable) and purchase a new power supply.



1 - User Port
2 - Cassette Port
3 - Serial Port
4 - Audio/Video Port
5 - Antenna Jack
6 - Channel Select Switch
7 - Cartridge/Expansion Port
8 - On/Off Switch
9 - Control Port 2
10 - Control Port 1

Fig. 1 Commodore C64 Connections

[1] Ward Hurst was formerly the Supervisor, Instructional Computing for Polk County Schools. Hurst attended Commodore Training School in 1985.

The most common cause of C64 power supply failure is excessive heat. When you are not using the 64, disconnect the power supply from its source of AC current, as it will remain "on" even when the C64 power switch is turned "off".

NOTE - Computer Specialties, Melbourne, make a C64 power supply that provides surge/noise protection, has accessory outlets to power the monitor and diskdrive from a single power cord, and it has an on/off switch. The CSI power supplies (at the time this is being written) for about $45.00. The price is competitive with Commodore's replacement power supply and provides added protection for the computer.

Outside the power supply, another common cause of C64 failure is a blown (1 amp) fuse located inside the cover. Symptoms of a blown fuse are:

a. The LED indicator comes on, and
b. Nothing else works!

With the power supply unplugged, remove the cover and replace the fuse if the thin wire in the center of the glass is broken.

NOTE - If you've never opened up a C64 before, proceed carefully. Pay particular attention to the way the wires route around the various parts. The keyboard cable can only be connected to the mother board one way. Put everything back the way you found it!

The composite video out port of the 64 is of two types, 5 and 8 DIN pin. The five pin out connects to the front audio-video in plugs of the 1702 monitor using a special five pin interface that does not come with the 1702. Be sure the monitor' switch is on the "front" position if the five pin outlet is used.

Some of the original C64's were made with socketed chips on the mother board. Now, most of the current C64's have their chips soldered directly to the board. If your CPU is bad, Commodore will replace it with a refurbished one for about $55.00 (at the time of this writing) plus shipping. If you cannot find a local dealer, write to the Schaumburg, Illinois address for details or the address of your nearest dealer.

NEVER insert or take out a cartridge with the C64's power on. It can destroy the ROM chips in the cartridge, and thus the software, and may possibly damage your C64's mother board. Chip 82S100 usually blows if a cartridge is inserted with the power on.

A bad joystick will cause a C64 to behave as if it were broken. If you experience problems with a joystick plugged into port 1 or port 2, unplug the joystick and try again. If necessary, replace the joystick. Be aware that static electricity sparking against one of the joystick ports when you reach to turn on the computer can burn out a chip (usually one of the 6526's on the mother board).

The expansion port of the C64 can be bad and not affect the rest of the computer's operation.

Outside the power supply and the C64's fuse, two other common failures are the keyboard and the mother board video chip.

The two 6526 chips (board locations U-1 and U-2) on the mother board of the C64 interface the keyboard to the rest of the computer and control the user port and the disk drive socket.

The chip on the C64's mother board that is housed inside the box cage is the video chip (board location U-19). It is always socketed and controls many Commodore 64 video functions.

Commodore 1541 Disk Drives

The 1541 came in two models. The older ALPS drive had a garage style door. The newer NEUTRONICS drives have the push latch.

The 1541 is very prone to heat buildup from prolonged use, particularly from metal expansion of the cam shaft. It should be allowed time to cool off between period of significant use. It also frequently needs a stop gap adjustment as a result of prolonged use and from loading "protected" software. The newer latch style dirve made my Neutronics has a lot of the heat problems corrected, and seldom needs the above adjustments.

The 1541 disk drive uses a 35 track format and leaves the directory of a diskette on track 18. Load command for the directory is:

```
LOAD"$",8       The $ is a substitute symbol for the word
                "directory".
```

The 1541 drive loads programs rather slowly as it transfers one byte at a time down the line trough its serial interface.

Each 1541 formatted disk will have a unique disk name and disk ID number. The disk name is purely cosmetic, but

the two alpha character, two digit, or combination thereof (example AB, 29, C5) ID number is critical to the operation of the drive. The unique ID number is used to label each sector of the disk. Programs that claim to change the ID number of the diskette are worthless because they change only the ID on track 18, and not the ID already recorded on the sectors.

Speed adjustment of the 1541 can be critical to the loading process and should be preiodically checked using diagnostic software or the strobe method.

The red LED on the drive can be a good indicator of "alignment problems." If it remains on steady while the drive is loading a piece of software (it will flicker occasionally with protected software), then the drive is probably in correct adjustment. If, however, it constantly flickers while loading, this is a good indication that some adjustments are necessary. It will not be long until the drive will not load at all.

Beware of any "copying" program that constantly bangs the head. Such a program is bad for your 1541 and will cause a drive adjustment to be necessary after a short span of use.

Track one errors usually mean a stop gap adjustment is necessary. Track 35 errors indicate a speed adjustment or radial head alignment is necessary.

The 1541 will not save a program to disk using the normal SAVE"PROGRAM NAME",8 if a program by that same name is already on the disk. To avoid this minor aggrevation, use the command SAVE"@PROGRAM NAME",8. This will save and replace a program of the same name.

The 1541 disk drive has a tendency to become "lost" in its ability to find programs on a disk. Should this occur with a drive previously working fine, insert a blank formatted disk and type in the following program to initialize the drive:

```
OPEN 15,8,15
PRINT #15,"I"
CLOSE 15
```

This should cause the drive to position itself on the directory track and will help the drive "find" programs in the loading process.

Basic Troubleshooting for the C64

The following is a list of problems and possible solutions. Some of the checks require a Volt/Ohm Meter (VOM), Disk Drive, Diagnostics Diskette, and a known good printed circuit board (PCB) and power supply.

Problem: Turn on the computer and nothing happens.

Check:

a. Is the power supply plugged into the AC outlet?
b. Is the power supply connected to the computer?
c. Is the television or monitor on and connected?
d. Check the on/off switch for continuity with VOM.
e. Disconnect power connector CN7 from the computer. Check as follows:
   11VAC across pins 6 and 7
   5VDC across pins 2 and 4
   If voltages not correct, replace power supply. If correct, check fuse on mother board. If fuse is blown replace. If good, change mother board.

Problem: Screen powers up with garbage.

Check:

a. Is 5VDC and 11VAC correct? (see above)
b. Is the monitor or TV properly connected?
c. Turn on computer again. If still incorrect, suspect mother board.

Problem: Joysticks/paddles not working properly.

Check:

a. Insure the program that uses joysticks is working correctly.
b. Check the control port with a known good joystick.
c. Check the joystick with a known good control port.
d. Change joystick or mother board.

Problem: Characters depressed on the keyboard do not correspond with the characters on the screen.

Check:

a. Turn off the computer, remove cover, remove 8 keyboard retaining screws.
b. Check the keyboard switch visually, clean switches if necessary.
c. Examine the wire harness between the keyboard and the mother board. Check with VOM if necessary. Check with known good mother board to insure proper operation.
d. Re-seat the keyboard on the mother board andcheck the 20 pin male connector CN-1.
e. If still not correct, replace mother board.

Problem: Cartridges do not work correctly in expansion ports.

Check:
a. Insure the ROM cartridge is not defective.
b. Inspect the expansion port visually for defective pins. Pins may be spread too far apart for cartridge to sit correctly.
c. Re-seat cartridge. If still bad, replace mother board.

Problem: Video monitor works correctly but television does not.

Check:
a. Insure TV/monitor switch is connected along with the television. Channel select switch is in the correct position (See operations sheet).
b. Change mother board.

Problem: Video monitor screen or audio defective.

Check:
a. Check monitor for proper color adjustment and volume control is turned on.
b. Make sure front/rear switch in back of monitor is set to proper input. Check cable with VOM.
c. Change mother board.

Problem: Disk Drive not operating correctly.

Check:
a. Make sure the disk drive is a good unit.
b. Re-seat the serial cable in CN-4 on computer and P2 or P3 on the disk drive.
c. Insure the commands are correct by checking the disk drive user manual.
d. Change mother board.

Problem: Datasette cassette not operating correctly.

Check:
a. Make sure the cassette is a good unit.
b. Remove female connector on CN-3, clean the 12 pin edge connector (contact cleaner).
c. Insure the commands are correct by checking the cassette user manual.
d. Change mother board.

Problem: Peripherals connected to user port do not function correctly.

Check:
a. Make sure the peripheral device such as a modem is working properly.
b. Remove female connector from CN-2, clean the 24 pin edge connector (contact cleaner).
c. Insure the operating commands of the device are correct.
d. Change mother board.

If a diagnostic disk is available, run "C-64 BURN-IN". This program checks various IC's and other circuits on the mother board. By pressing the F5 key, the program will check for sprite and video problems.

IBM AND COMPATIBLE COMPUTERS

by

B. R. Black

NOTE - The following information applies only to the early model IBM PC's and compatibles. IBM Personal Systems (designated "PS/2" models) were released in April, 1987, and constitute a completely new approach. Micro Channel connectors on several of the new motherboards, "pointing devices" (mice), two new and different specifications for disk drives, new diagnostics, and this year, a new graphic operating system - OS/2 - make "Personal Systems" troubleshooting different than "Personal Computer" troubleshooting...at least for the next several years. Surface mount technology will increase the reliability of the new PS/2 machines, but entire boards will be exchanged instead of discrete components if or when a minor part fails. The consumer may still benefit as repair time is reduced to a minimum.

A number of alternatives abound to catch the unwary. Those ancients who remember CP/M may recall statements that "CP/M will always be around" and that "MS DOS will never replace CP/M!" If I were investing my money in several new computers that run under MS-DOS, I'd make certain they were also "expected" to run OS/2 when "it" in some form finally arrives in the next two or three years. Even with the new MS-DOS 4.0, certainly within the lifespan of today's purchases, MS-DOS may well be the CP/M of the 1990's. Sure MS-DOS will be around...just like CP/M is still "around"...somewhere.

So I'm sure there are good reasons to purchase OS/2 and the new machines that use the new operating system. Just as soon as I figure out a good reason, I'll pass it along.

GENERAL INFORMATION

The following is a summary of tips, advice, and notes based on attendance at the IBM PC Maintenance Course in Atlanta several years ago and trying to maintain over 125 IBM PC XT's and AT's in Polk County Schools for a year.

At the outset, to clear the air, IBM made a very rugged little computer - nothing fancy - just plain and very reliable most of the time. One Polk County school reports that after five years, their original 15 IBM PC's have only suffered one CGA card failure and the usual early model disk drive door failures, and minor disk speed adjustments. Other computers are faster, less expensive, and may sometimes be just as reliable. It would be impossible to check out all of the "other brands". What has been included here will usually work on IBM PC's. After that, if you have another brand, you're pretty much on your own.

POWER ON SELF TEST (POST)

About 60 percent of the early PC's problems will be announced to the user by the IBM computer's POST program. The POST program executes automatically every time the computer is powered on. The purpose of the test is to verify that each of the components is working properly. The POST program checks the following:

System Board
Memory (RAM)
Primary Display Adapter
Keyboard
Diskette Drive Adapters
Fixed Disk Adapter
Expansion Unit (if any)

Basic System Test - Verifies the micro-processor is alive and well, tests ROM based Basic Input Output System (BIOS) and the first 64K of memory.
Error Indication - System stops with NO error message or audible beeps.

Extended System Test - Checks Read Only Storage (ROS) which contains the 8K version of BASIC and the system timer.
Error Indication - System emits one long beep followed by one short beep...just before it stops cold.

Configuration - The dip switches which set the configuration of the system are read into the first segment of RAM. Memory on the display adapter and video signals are tested.
Error Indication - Errors are indicated by 1 long beep followed by two short beeps. POST program continues.

Memory Test - The system checks the memory available against the memory set up in the configuration switches. In the XT, the memory is counted in 16K increments.
Error indication - If an error occurs in the memory check, the error message will appear: "XXXX YY 201" where XXXX is the failing bank of memory and YY is the failing module in the bank. (The Hardware Maintenance and Service Manual has a map for figuring out which RAM chip needs to be checked or changed.)

Keyboard Test - Checks for circuit board failure and stuck keys.
Error Indication - A 301 message indicates a sick keyboard. The message "XXX 301" indicates a stuck key where XXX is the scan code of the particular key needing help.

Diskette Test - The status of the drive is determined after a recalibrate command.

Error Indication - A 601 message usually indicates a bad diskette drive.

Other Messages - Other error messages may appear such as 1701 (Fixed Disk Drive) or 1801 (Expansion Unit) or sometimes in combination with other messages. For example:

30000 00 201
1701
ERROR (Resume = "F1"Key)

In the event of multiple error messages, always attempt to correct the first error listed first.

Successful Completion - One short audio beep is sounded and DOS is loaded if available. If DOS cannot be found, 8K BASIC is loaded from internal memory.

NOTE -- If a school calls and explains that all they can get is some sort of BASIC screen on their AT or XT, have them load a DOS diskette and "warm boot" the machine with a (Ctrl)(Alt)(Del). The DOS program should load from Drive A. Change into Drive C again and try the programs.

a. The computer may have "lost" the Command.Com program or something relatively minor on the hard disk...
b. The computer may have lost the two hidden files on the hard disk...
c. The computer's hard disk drive may have decided to return to Boca Raton for the winter.

If still in warranty, stay relaxed and calm. Tell the school that the district's tech. support types will be there shortly.

Until the price of hard disk drives sank faster than the price of several computer stocks, a hard drive (fixed disk) failure was cause for cold sweats. At one time, 20 MB hard drives were about $1500 outright, and about $1000 exchanged. Now, 20MB hard drives are less than $300 with controller card...and take up less space!!

GUIDE TO OPERATIONS

A Guide to Operations (GTO) is furnished with each IBM PC computer. It assists the user setting up the machine and provides a beginner's level diagnostics disk that the user can keep to help isolate a problem with the computer. The GTO provides information about customer replaceable units which are usually just unplugged from the back of the machine. Most manufacturers furnish similar books with their computers. The trick is keeping track of the books so that they can be used.

In the case of user maintenance, the customer is not expected to remove the cover of the computer--nor is it necessary for user level diagnostics. The Guide to Operations includes the following sections:

Installation
Problem Determination - Simple yes/no questions that guide the user through the diagnostics.
Operations
Option Installation
Relocation - What to do to get ready to move the machine.

> NOTE -- Spend the time during staff training to teach the use of the Guide to Operations and the user diagnostics. It is NOT difficult and knowing exactly what is wrong may save the district repair staff, and the school, time and effort. Generally, any time the school gets the message, "ERROR (Resume = 'F1'key)," it's a good idea to load the user diagnostics and check everything out. It's another example of a training investment that will pay off.

HARDWARE MAINTENANCE AND SERVICE MANUAL

The next level above user maintenance calls for the use of the Hardware Maintenance and Service Manual (HMS). The HMS manual for each machine includes the "Advanced Diagnostics" disk which can be used by the technicians to examine the failed unit for "field replacement units", parts that can be replaced easily by opening the box.

Hardware manuals are specific for each type of machine and usually come in two or more volumes. Contents include:

VOLUME I
- Introduction
- Diagnostics
- Problem Isolation Charts (PIC's) - Will guide the technician through problem determination like a road map.

VOLUME II
- Locations - Where various components are found.
- Removal/Replacement/Adjustments
- Switch Settings
- Parts Catalog
- Index

Each set of HMS manuals also includes the advanced diagnostics disk for the machine covered by the manual, and a selection of "wrap plugs" to be used to isolate problems with various adapter cards. The price of each manual varies. For example, the XT HMS manual cost $295.00 and was included in the price of

the Atlanta technical training class. The older PC HMS manual was also included with the technical course.

The PC AT manual and selected technical reference manuals were purchased from the nearest customer center. For example, the XT Technical Reference was only $30.00. Plan to purchase an adequate supply of manuals and references for the equipment selected by the district. They're another good investment.

Two hints on working with the Problem Isolation Charts. First, start with the first error code indicated by the POST or the diagnostic program. Quantum leaps of deduction usually are not necessary. Keep it simple. Second, once you've taken the action called for by the manual, STOP! Go back and run the diagnostic from the beginning. You may have fixed the problem and don't need to change anything else "just for good measure."

Be sure to protect components from electrostatic discharge (ESD). Handling a styrofoam cup can generate 1500 volts of static electricity. Keep adapter cards and chips in the special antistatic envelopes until needed.

> NOTE -- Leave the unit plugged into the wall after turning the machine off. The three wire plug maintains a good ground. Then touch the power pack cover to make absolutely sure any charge is dissipated before touching any of the adapter cards, etc. See the section marked "General" for more information on static electricity.

Be sure the machine is off before pulling an adapter card from the machine. (Apple IIe's have a red LED next to the power supply to warn the novice repairman.) The small microchips cannot withstand the arc that develops as the card is pulled with the power turned on.

IBM has a good exchange program in place for keyboards and monitors. All it takes is one keyboard to assist the technician in its own disassembly and the exchange program looks even better. Early IBM monochrome monitors were nearly without hope. Most of the adjustments were inside, and like Maytag, IBM repairmen need something to work on. Usually a 10-cent resistor or a vertical hold adjustment was found to justify the $70.00 plus parts minimum charge. If really pressed for time (read "the district had no spare monitors") or if the monitor smelled like burned orange juice, the monitor was exchanged for $150.00.

NOTE -- School custodians and district property inventory staff like to permanently mark keyboards, monitors, and other "exchange parts" with orange paint, metal plates epoxied to the plastic case, and other permanent refinements which make the component non-exchangable. If so marked, IBM, or almost any other manufacturer, cannot exchange the component. All the technician can do is try to fix the permanently marked part. This should not be used as an excuse to avoid marking the computer. Just be aware that exchange options may be limited afterwards.

NORTON'S UTILITIES

Sometime, somewhere, and at the worst possible moment, anyone who uses a computer (mainframe or micro) will erase (or flush) a file. In the case of an erased PC-DOS or MS-DOS file, help is only a program away. Called "Unerase" and found on a Norton's Utilities disk, this program will sometimes save hours of work rebuilding database files and records by hand.

A word of caution. Unerase works because all that is really removed when the delete or erase command is used is the directory entry. The data still exists on the floppy disk until new data is rewritten on top of the old. The unerase program can only work on files that have not been written over -- new data or files written on the sectors previously used by the "erased" file will "cover up" the old data.

Norton's Utilities also has a quick check for hard drive ailments that checks the disk for bad sectors. At one time, it marked bad sectors on potentially weak 20MB drives faster and better than some of the dealer supplied programs. Norton's Utilities also provides a map of the fixed disk that shows how much space remains.

NOTE -- One of the really nice programs in Norton's Utilities was designed to print program files. It does nice things like add the date, page number, and skips over the perforations between the pages of computer paper. Those that download long multi-page ASCII files from FIRN or other sources may find the program very useful.

The latest version of Norton Utilities is 4.0. An "Advanced Edition" is also available now which allows the fixed disk to be reorganized for faster operation and includes a "FormatRecover" program to recover data from an accidentally formatted disk drive. I wouldn't want to use it, you understand. It's just comforting to know that such a program is available in my file cabinet. The list price for Norton Utilities 4.0 is $100.00 and the Advanced Edition 4.0 lists at $150.00. The programs are available at considerable savings if the buyer is willing to look in several magazines.

Our original purpose was not to sell Norton's Utilities. Alternatives are available such as Mace Utilities, for example. However, a district maintenance technician or a school that depends on an MS-DOS or PC-DOS computer should not be without a legal copy with the handy manual that is supplied with the utility disk of their choice.

This final message is to all district or school administrators responsible for maintenance and maintenance training: Allow sufficient staff and sufficient time to perform maintenance and maintenance training for users. From a practical standpoint, it usually takes almost twice as long or three times as long as logic says it should to do anything with or to a computer. I'm sure Murphy would have included it in his laws had he enjoyed the use of WordStar and other friends.

OTHER SOURCES OF INFORMATION

Occasionally, an excellent article pops into a magazine or journal that provides a wealth of information. Such an article has been included in this section of the guide. The article, " Troubleshooting PCs and XTs, Diagnosing The Frequent Failures" was found in the July-August, 1988 edition of Micro Cornucopia. Written permission has been granted by Micro C to reprint the article for this edition of the Polk County guide.

The article tends to stress the technical side of the PC diagnostics and repair spectrum and is intended for those with sufficient technical background to use the information. Remember to follow the safety precautions discussed in the "General" section if you even think about working on a monitor.

NOTE - In the event this section becomes separated from the reference section in the back of this guide and you think the article warrants a subscription ($18.00 per year), the address is:

Micro Cornucopia
PO Box 223
Bend, Oregon 97709
(503) 382-8048

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Troubleshooting PCs and XTs

Diagnosing The Frequent Failures

Don Evans works for a technician training company and one of their services is supporting the technicians they've trained. If their emphasis on quick diagnosis surprises you, then you probably haven't worked in a shop. This is an introduction to how they work.

Back in early 1979, I escaped from the Iranian Revolution on a military C-130, returned to the States, and found myself in the PC Revolution. Two years in Iran had not prepared me for computer stores or the latest in beach fashions. But I pulled myself together and got a sales job with CBI, one of the original Apple Computer distributors. I was a somewhat technical salesperson, and over time I acquired a reputation for technical support.

This reputation was largely buoyed by an understanding of three of four failures very common to the Apple II, and a little common sense.

The most common failure, the tendency of the Apple to lose data because of dust or corrosion on the language card's edge connector, made me a hero with friends, neighbors, teachers and the Apple dealer. The fix: turn off the machine, take out the RAM card, clean the contacts with a pencil eraser, and put the card back.

The company Dan and I now work for, National Advancement Corporation (NAC), trains technicians in the fine art of maintaining IBM personal computers and compatibles.

One way to improve troubleshooting logic is with flow charts. We've spent thousands of man hours developing ours. But we've also found two other very effective methods. One we call "frequent failures" — watching for common symptoms to common problems. The other method requires a diagnostic ROM.

No matter which method you use: don't set out to do a component-level fix unless you're pretty sure you can find the problem quickly. Our rule is the "ten minute limit." If we don't think we can find a problem within ten minutes, we usually send it out.

There's no percentage in trying to work on an unfamiliar unit, or to identify an unusual problem. It's too easy to waste many hours.

Frequent Drive Failures

I wouldn't like to admit how many Seagate 225s, 238s, and 213s we sent out for repair before we discovered how to fix a frequent failure.

Symptom: Drive loses data and format (more noticeable with temperature changes).

Solution: The problem is caused by expansion of the chassis as the drive warms up. The circuit board mounted on the underside does not allow the case to expand normally as it heats up and the drive loses its alignment. Three screws hold the circuit board to the drive housing. Loosen the screw nearest the front of the drive.

Editor's note: You'll need to loosen all three screws if the holes on the board and the housing don't line up. Line up the front hole, then tighten down the back screws and leave the front screw just finger tight. (It's the way Seagate is currently shipping 225s.)

Then reformat the drive (low level, fdisk, and DOS format). Be sure you have an up-to-date backup of the drive before loosening anything.

IBM Monochrome Monitor (5151)

Symptom/Solution 1: A blank screen indicates a bad fuse, probably caused by a shorted transistor (location TR23; this can be a BU406, BU407 or BU408). Do not use a cross-referenced component.

To disassemble the monitor, disconnect the power and signal cables from the system. To remove the two screw covers on top of the monitor, use a small flat blade screw driver and pry up the back of each cover. Next remove the two Phillips screws from the top of the monitor and turn it face down. Remove the six screws on the bottom of the case. Don't remove the feet or the two screws next to where the cables enter the monitor. Pull both cables from behind the plastic flange. You can now lift off the case.

If you still do not have a picture after replacing the fuse and the transistor, check for a glow in the back of the CRT (this will tell you if you have power). If there is no glow and the fuse is still good, the main power transformer probably has an open primary. Don't fool around, the transformer's primary is connected to 110 VAC.

If you have no picture but you have a glow in the back of the CRT (you've replaced the fuse and transistor), quickly turn off the monitor. Check the heat sink at the transistor you just replaced (location TR23). Careful, it may be very hot. If it is getting hot, the flyback transformer is shorted and needs to be replaced.

Editor's note: Flyback transformers were invented in the Australian bush, so you have to be careful with them. Technicians have been injured trying to throw them away.

This part is available from Computer Parts Exchange (CPX), Chatsworth, California, phone (818) 709-4003. CPX also has a facility in New Jersey, phone (201) 389-8333. Another source for this part is Acetron Dataproducts, Van Nuys, California, phone (818) 786-9789.

Symptom/Solution 2: Full brightness unaffected by the brightness control. This indicates a bad resistor (location R515; its value is 180K ohms at 1/2 watt).

Symptom/Solution 3: The symptom of the third "frequent failure" on the 5151 is a horizontal line across the screen. This indicates a bad chip (location IC4[illegible] it is a TDA1170 IC).

I.S Change 3, Sept. 1988

By Dan Evans with Don Doerr
National Advancement Corp.
17985 Sky Park Circle, Ste. E
: .ne, CA 92714

Floppy Disk Drives

Symptom/Solution: Read/write failures are most often caused by the drive being out of alignment. It is not our intent to teach drive alignment in this article. That kind of instruction is better left for a hands-on situation.

Editor's note: Allyn Franklin has been teaching floppy alignment at SOG, he'll be back this year to talk about floppies and hard drives.

Technicians often tell us they throw away bad drives, so we've asked them to toss them our way.

We've found that about 35% work perfectly. About 50% need only three to five minutes of attention to clean up alignment. About 15% need a read/write head, motor or chip (usually a preamp or stepper driver IC).

Dead PC Or XT

Symptom/Solution: System appears dead. There is no display, no beep, and no error message when power is turned on. Replacing the power supply doesn't help. Replacing the system board fixes the problem, but what's wrong with the system board?

To understand this one, let's look at the power-on self test (POST). The IBM POST routine, located in the BIOS ROM, runs numerous tests of the system board and add-on boards. If any of the first 11 tests fails, you'll see no cursor and no error message. The system appears dead, even if the failure is simply a bad chip in the first 16K (critical bank) of RAM.

A bad RAM chip in the first 16K accounts for about 50% of all dead system boards.

In the case of the PC, some compatibles, and sometimes the XT, the critical bank of RAM is soldered in, making it impractical to troubleshoot by swapping chips.

So we use the WindsorPOST diagnostic ROM module, made by Windsor Technologies of San Rafael, California, (415) 456-2200.

> I wouldn't like to admit how many Seagate 225s, 238s, and 213s we sent out for repair before we discovered how to fix a frequent failure.

The WindsorPOST replaces the socketed BIOS ROM. It does 36 diagnostic tests on power up, and about 70% of the time it will pinpoint the problem in an apparently dead board.

When the system is turned on, WindsorPOST beeps to announce that it is working. A red LED indicates whether or not the ROM socket is getting 5 Volts. The module then initializes the video display and starts its tests. Because the tests are all run from the WindsorPOST ROM, not much of the system needs to be running.

The WindsorPOST tests include the 8088 Microprocessor, first 16K of RAM, 8237 DMA Controller, 8259 Interrupt Controller, 8253 Timer/Counter, 8255 PPI, Read and Display Switch settings, Cassette Relay (PC Only), speaker and related circuitry, the IBM-PC ROM, full system RAM (to 704K), plus video attributes and RAM on the Monochrome or Color Monitor Adapter.

We received one of the first WindsorPOST units about a year ago and have used it to locate failures on system boards, video display adapters, and memory expansion units.

Our graduates tell us they can isolate about 70% of all system board failures to the chip with the WindsorPOST module. (All without the use of an oscilloscope or logic probe.)

Another fifteen percent (15%) of failures can be attributed to the clock circuit, Non-Maskable Interrupt (NMI) circuit, or a Data/Address Line failure. These problems can often be isolated with an oscilloscope via the following:

1) Jumper pin 10 to pin 20 on the DMA Controller (location U35 on PC, U28 on XT) and turn on the system. If this solves the problem, replace the DMA Controller.

2) Check for a 4.77 MHz clock on pin 8 of the clock chip (location U11 on PC, U1 on XT). If there's no clock, check the clock chip and the crystal.

3) Check for 4.77 MHz clock at pin 8 of the 74LS04 (location U51 on PC, U89 on XT). Replace the chip if there is no clock.

4) Check for 4.77 MHz clock on pin 4 of the time delay (location TD2 on the PC or XT). If no clock is present, remove the time delay and replace with a 470 Ohm resistor across pins 1 and 4 on the system board.

5) Check the signal at pin 9 of the 74LS74 (location U96 on PC, U86 on XT) for a HIGH or FLOATING signal. If a high or float is found on this pin, replace the chip. This signal is the ALLOW Non-Maskable Interrupt (NMI).

6) Replace the 8088 processor. It's socketed.

These steps should help you locate 85% of all system board failures within five minutes.

Most of the other 15% are caused by a stuck address or data line. In many cases, you can find these problems with an oscilloscope.

If you're not very experienced, we don't recommend that you try to remove or install soldered-in ICs.

Finally

I hope that this information will save you time and money. If you have a solution to a "frequent failure," or are looking for a solution not mentioned here, please contact:

Don Deerr
National Advancement Corp.
2730-J South Harbor Blvd.
Santa Ana, CA 92704
(714) 754-7110

Editor's Notes On WindsorPOST

I received the ROM from Windsor Technologies just a couple of days before the final, final, final deadline for this issue so I'm just beginning to check it out. However, I did hop over to MicroSphere to rummage through their boneyard. This is what happened:

The first system was a Kaypro XT clone. It wouldn't display anything no matter what video board. I wasn't optimistic but I tried the ROM. Nothing on the screen, though I did get the introductory beep and two beeps later on.

The second system worked, but I stuck some suspect RAM into it to see how well Windsor isolated RAM problems. Windsor reported no errors so I bent a pin on one of the RAM chips. (It seems that every second or third system I work on, I accidentally bend a pin or a socket doesn't work right, so open pins are a pretty common problem.)

First I bent under pin 10 (address line 5), reset the system and guess what? No error. Now, there's a reason Windsor's missing the problem. The processor doesn't care where data winds up in RAM. It just issues an address and data. Later, when it reissues the address, it expects to read the same data. Well, a disconnected address pin won't change that. However, that missing pin will cause later data to be written over earlier data since only half the RAM chip is being used.

The way to detect this kind of error is to write all ones to the first half of memory and all zeros to the second half. Then go back and read the entire first half, looking for zeros. The starting address of the zero and which bit contains the zero tells you which chip and which address pin are defective.

I fixed the address pin and disabled the chip by bending out pin 15 (CAS). Windsor didn't miss this one. However, according to markings on the circuit board, I'd zapped bit 7 in bank 0. Windsor told me I had a defective bit 0 and a defective parity bit. Both in bank 0. It got the bank right.

However, it's possible the board was marked wrong, and of course the system would generate a parity error if there were a single bit failure. Windsor should have been smart enough to expect a parity error when it saw the single erroneous bit, so it shouldn't have reported a problem with the parity chip. (In fact, it should have reported a parity problem if it didn't receive a parity error.)

I also tried a dead board, one which had succumbed to a power-supply failure. I had checked a few obvious things earlier. I'd replaced the 8088 and I knew the processor was getting a clock signal. However, Windsor didn't so much as beep. Ah well, probably not their fault.

I'm going to let MicroSphere use this diagnostic ROM for a while to see how helpful it is in real life. (They were very anxious to try it.) I'll keep you posted.

Editor's Suggestions:

As long as I've gotten off on this tangent, I have some suggestions for those of you who are writing RAM diagnostic routines. Be sure to check for bent pins, especially address pins. Turn off refresh, write to RAM and then read at ever-longer intervals. (Remember, a read is a refresh.)

The length of time a RAM remembers its data is one test of RAM quality. (Some RAM chips can remember their data as long as 1 second without refresh.) If you have a flaky RAM chip, hopefully it'll be the first one to forget.

Of course you'll also want to include the standard tests, such as alternately writing and reading 5555 hex and AAAA hex to check for stuck bits and cross talk.

Finally, if you have servicing tips (or recommendations on diagnostics), please write Micro C or call our RBBS. Techtips are the most popular part of the magazine (though it hurts to admit it).

♦ ♦ ♦

HANDS-ON PC REPAIR TRAINING

NAC offers the highest quality advanced training available for PC technicians. The course and its documentation focus on the IBM personal computer lines, from PC to PS/2, peripheral devices, and compatibles such as Compaq and AT&T. Network maintenance training is also available.

- Diagnose more quickly and accurately, complete repairs faster, and reduce costs.
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Our five-day PC Maintenance Course is offered in California, New York, Washington, Atlanta, Chicago, St. Louis, Dallas, Seattle, and other major cities. Call without obligation to get a course outline and dates for the class locations most convenient to you.

National Advancement Corporation
Computer Hardware Training Specialists

2730-J South Harbor
Santa Ana, CA 92704
(714) 754-7110

Reader Service Number 39

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Change 3, Sept 1988

DIAGNOSTICS

for Personal Computers from *Windsor Technologies*

Windsor Technologies offers a family of diagnostic products for IBM PC, PC XT, PC AT and compatible computers. Originally designed for and used by service industry professionals, *Windsor's* products are well suited for anyone involved in the management and maintenance of personal computers.

PC-Technician™

Professional Level Personal Computer Diagnostic System

PC-Technician is an 'advanced' type diskette-based diagnostic system that provides comprehensive testing for each individual system component. Information about the testing and the results are presented via text and graphics on the system's display. *PC-Technician* provides on-line help displays and information about the system's configuration.

PC-Technician is ideal for service personnel, manufacturers, OEM's, and users who need detailed information about the status of their computer's hardware.

PC-Technician is available in the following configurations:

- **Product Code T01 (for PC, PC XT) $195.00**
- **Product Code T51 (for PC AT) $245.00**
- **Product Code T90 (for PC, PC XT, PC AT— T01 and T51 in the same carrying case) $395.00**

A FREE Evaluation Diskette is available—see the coupon below.

T90—PC, PC XT, PC AT

WindsorPOST™

Personal Computer Diagnostic ROM Module

WindsorPOST is designed to be used when the system is malfunctioning such that its 'power-on-self-test' (commonly called POST) does not complete satisfactorily and a diskette-based diagnostic product, such as PC-Technician, cannot be loaded and used for troubleshooting.

WindsorPOST temporarily replaces the system's BIOS ROM module. When installed, its LED indicates if the proper amount of power is at the BIOS ROM socket. It then performs 36 tests on the circuits and electrical components on the system board, the system memory up to 640K, and the color or monochrome video display memory. Errors are identified down to the module (chip) level in three full displays of information on the system's video display unit.

WindsorPOST is intended for those service operations where specific identification of failing components is required and where soldered components are removed and replaced. *WindsorPOST* has been in use in the field for over one year and performance data indicates that it properly identifies the failing component at least 70% of the time.

WindsorPOST is currently available for use on IBM PC's and PC XT's (a PC AT type product is under development) and those compatible systems where the system board circuitry and components are extremely similar to the IBM standard. *WindsorPOST* comes with a 30-day money back guarantee.

- **Product Code P01 (PC, PC XT) $295.00**

P01—PC, PC XT

For immediate ordering, contact *Windsor Technologies* at (415) 456-2200 8:30 AM-5:00 PM Pacific Coast time. VISA, Mastercard, American Express and COD orders accepted.

Volume discounts and reseller discounts are available.

Windsor Technologies, Inc.
130 Alto Street
San Rafael, CA 94901
(415) 456-2200

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130 Alto Street, San Rafael, CA 94901 · (415) 456-2200

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MC 0788

TROUBLESHOOTING THE TRS-80

by

John Barber[1]

Did you know that the name of the TRS-80 was derived from the fact that the original Model 1 had 80 integrated circuits? Well, it's true but don't worry, that's all the trivia. I wish that I could tell you that repair of the TRS-80 was as simple to understand as the preceding bit of trivia but, unfortunately, I can't. Radio Shack does not advocate the "cookbook" approach or the "try changing this - if the problem is fixed, fine, if not then do this" approach to computer repair. Their service manuals are not troubleshooting guides with a list of symptoms and the possible cures. Their approach is one that requires a solid grounding and understanding of digital logic theory. If you are such a person, then purchase the appropriate service manual from Radio Shack for your computer and dive right in.

In the event that you are not the technical person described above, do not despair! There are still some things you can do in terms of maintenance and repair if you can answer no to the following questions:

1. Do you think a screwdriver refers only to a type of mixed drink?
2. Is your computer still under warranty?
3. Do you drop things a lot or bleed at the slightest provocation?
4. When you work on things do you always have spare parts left over.

The above questions may seem silly but if you are not comfortable with the thought of opening the computer up then don't do it. Everythling that we will discuss doing requires that you remove the cover.

In this discussion we are going to concentrate on the power supply and the disk drives with a few other tidbits thrown in along the way. You might consider investing in the Radio Shack Service Manual for the Model III or IV, as long as you remember what I said about it not being a

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[1] John Barber is a computer instructor at Kathleen Junior High School in Polk County. John has taught several teacher institutes and has written and marketed a grade keeping program used by many teachers in area schools.

troubleshooting guide. You may still find some useful (and certainly interesting) information inside.

In passing, let me remind you that the district (The Polk County School District - Ed.) can now purchase parts directly from Radio Shack's National Parts Warehouse (NPW) at a considerable savings (on some items) over what you have to pay in the retail store. The district is also authorized to "swap boards" with the NPW.

NOTE - Polk County Schools wishing to order spare parts from the Tandy National Parts Warehouse should coordinate the order through B. R. Black (534-2267). Schools will need the part numbers and description of the parts. They will be advised of the prices and may then prepare an official purchase order.

As was mentioned earlier, the cover must be removed to do almost anything except use a head-cleaning diskette so let's start off by talking about how to take the machine apart. People are usually great at this. It's the putting back together that some of us have trouble with!

DISASSEMBLY

To remove the case, place the computer on its back panel to provide access to the screws on the bottom of the unit. There are ten screws that must be removed. Take note of the type of screw and its length. The easiest way to keep track of each screw and its respective position is to number each one by writing on two pieces of masking tape and fastening one piece of tape to the screw and the other piece of tape with the same number over the corresponding screw hole.

After the bottom screws have been removed, put the computer back in its normal position and remove the screw and washer from the back panel of the case.

Remove the case by lifting straight up and position it on its side to the left of the computer. Be careful not to catch the neck of the CRT when lifting the case and don't pull the video cable loose.

So far you haven't done anything irreversible and the computer will work in this position even though it looks a little weird with the display lying on its side and all the text sideways. A word of warning is appropriate here. Before the cover was off you were more likely to be in the upper quartile in salaries next year than to receive an electric shock. Now, however, with the innards laid bare you

are at some degree of risk. This is true even with the power off. The video monitor is nothing but a very large glass capacitor and can store a powerful charge for a relatively long period of time. It probably wouldn't kill you but it could ruin your whole day if you were to discharge it with your body. It's easy to discharge with a screwdriver and a piece of wire with gator clips on each end. (See CRT section in Chapter 1 - Ed.) Also, with the power supply, dangerously high voltages are present. This is true even with the switch off. Power is still being fed to the primary winding of the step-down transformer as long as the computer is plugged in. Finally, some of these components, especially faulty ram chips, reach temperatures of a soldering iron and can leave the manufacturer's logo etched in your skin if you touch them. Are you discouraged yet?

If you are working on a model IV you may have to remove the CPU board to get to the power supply and will certainly have to remove it to get to the Floppy Disk Controller board. Just remember the old masking tape trick and mark everything you disconnect!

POWER SUPPLY

The power supply in your computer is either two 38 watt units or one 65 watt unit and is probably either an ASTEC or TANDY brand. How do you tell if you have a power supply problem? Well, if nothing happens at all when you turn the computer on and you see no light on the back of the video tube when you look through the top vents on the computer AND you are sure the circuit you are using is good, it is reasonable to suspect a power supply problem. Another good indication of power supply problems is if the computer suddenly shuts down for no reason or if the screen image "blooms" several times and finally crashes.

The easiest way to tell for sure is to replace the complete power supply with one that is known to be good from another computer or, in the case of the units with two 38 watt power supplies, simply exchange the units. If the computer works after doing the above then you know the original power supply is bad.

For most of us, if the power supply is the problem, we are going to be limited to a visual inspection. Check the fuse first and if the fuse is blown, replace it. If you have the equipment and know-how, the next most likely failures are the Diode Bridge (DB1 or BR1), the Power Transistor (Q2 or T2), and the Catch Diode (D3). If any of these components are found shorted, replace. If the Power Transistor (Q2) is bad, be sure to check or replace diodes D2 and D3. Note that DB1 is a relatively high failure item.

I know that "if you know how" is not the most useful suggestion you've ever had, but if you don't know how to check for shorts or read resistor values you probably should stick to visual inspection and possibly switching the power supplies. (Can you say "Broken beyond repair, boys and girls?")

A particular problem that is common with the Model IV is the screen "blooming" followed by a crash. This is so common that there is a "fix-kit" available. The catalog number of the kit is 26-1080 and the part number is AXX 7098. The problem is with the resistor marked R15 which is a variable resistor. This should be replaced with two 510 ohm resistors joining where the center tap was on R15. The voltages should then be checked and should be between 4.95 and 5.25 volts. If the voltage is too high, a 1K resistor is added in series. If the voltage is too low, a 1K resistor is added in parallel.

The power supplies are usually very reliable and other than the problem just mentioned, they give dependable service. The type of board is marked and the component numbers are marked on the boards. See Figure 1 for the positioning of the power supplies within the computer.

DISK DRIVES

If you have dealt with disk drives on other machines you will not be surprised to learn that ALL drives are more similar than they are dissimilar. That is, they all have certain things in common:
Thing 1 - They all have drive motors to rotate the diskette.
Thing 2 - All have a stepper motor to control movement of the head assembly.
Thing 3 - They all have a head assembly that reads/writes digital information.
Thing 4 - All have a write protect sensor, index sensor, and track 00 sensor.
Thing 5 - They all have a logic board that contains read/write electronics.

Before we address disk drive repair we should have some reasonalbe suspicion that the drive mechanism is at fault. If a program won't load, will the computer function in ROM BASIC? To answer this, turn the computer on, hold the BREAK key, and while holding the BREAK key down, press and release the orange RESET button. Then release the BREAK key. If you get a CASS? prompt on screen press ENTER twice and you should get a >READY prompt. Enter a short BASIC program and run it.

If everything has worked up to this point, you have eliminated a large part of the computer as a problem area and the disk drive is more suspect than ever. If you don't get anything on the screen after following the above procedure, there are two things you need to check before proceeding further. First, (and I know this sounds silly, but we all have done things that made us look foolish) check to make sure the computer is plugged into a live outlet. Second, check that some playful cherub has not adjusted the two little wheels under the left-hand side of the computer that control brightness and contrast. These controls, when creatively maladjusted, can completely darken the screen. Surreptitious adjustment of these controls appears to be a favorite activity among some students who consider themselves to be wits (usually they're only half right).

If none of the foregoing produces any result, start checking the power supply. Let's assume that you successfully booted ROM BASIC. In immediate mode (no line numbers) type the following:

```
OUT 244,1
```

or

```
OUT 244,2
```

depending upon which disk drive you want to access and press the ENTER key. The appropriately numbered drive light should come on and the drive begin to run. Press the BREAK key to halt the drive. If the drive(s) run you can be sure that they are getting power and that the Floppy Disk Controller (FDC) board is addressing the drive. If you do not get the drive to run you may have a power supply problem or a problem with the FDC board. Refer to Fig. 1 for the power supply for the disk drives.

If you can successfully boot a disk, insert a known good test diskette that has been formatted using TRSDOS 1.3 and get to TRSDOS READY. At this point you can use one of the Model 4/4D/4P Diagnostic Diskettes available on loan from the district office (or directly from Radio Shack). From TRSDOS READY type DSKDG3 or DRV4M and press ENTER. The main menu selections are:

<W> WRITE WITH STATUS CHECK
<V> WRITE WITH READ VERIFY
<R> READ WITH STATUS CHECK
<H> HISTORY
<S> TRSDOS

CAUTION: Both <W> and <V> will destroy data! Use only with a test diskette!

With this diskette and the accompanying documentation you may check the ability of the drive to read and write data, the motor speed, the index pulse indicator, and track 00 switch, FDC alignment, head amplitide, and FDC logic failure among other things. Particularly useful is the

HISTORY option which will display a list of errors encountered during the tests. The types of errors encountered will give clues as to the possible remedies. (Some of the remedies are discussed in the documentation.) Before you use this diagnostic, I suggest you read the documentation marked DSKDG3 and DRV4M in the manual which may be borrowed with the disk.

If you find that you need to do an adjustment, use the TDC program from the diagnostic disk. From TRSDOS READY type TDC and press ENTER. Read the documentation marked TDC carefully and follow the screen prompts. Do the tests in order including the drive speed test which should be done first. Fig. 2 indicates the FDC Logic Board test points. The variable resistor marked R54 is the speed adjustment control. Be sure to avoid writing on the diagnostics diskette. Many of these tests write to the disk and will destroy the diagnostics data.

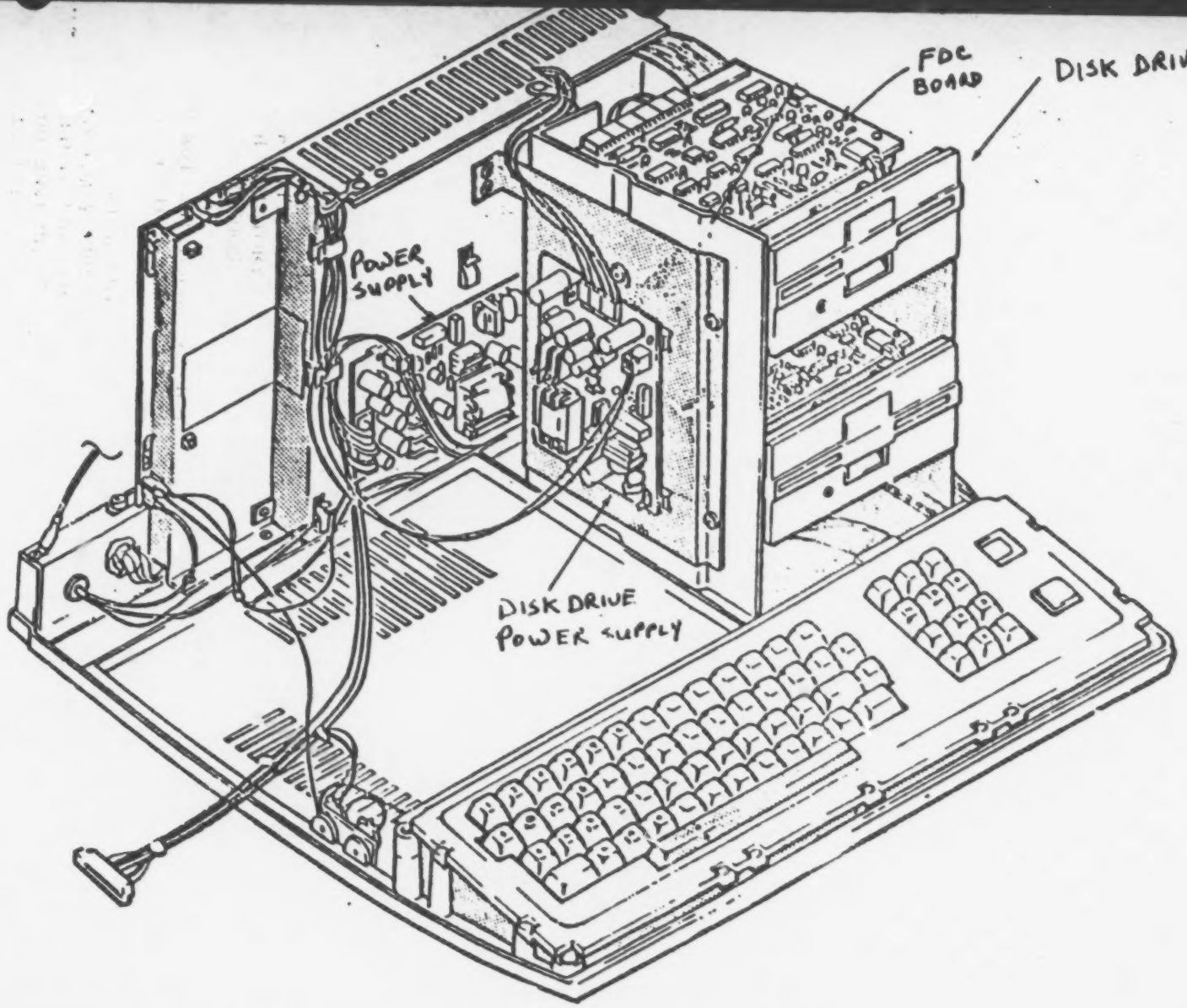
To run the rest of the diagnostics tests you will need a 35 MHz Dual Trace oscilloscope or better with 2 X10 scope probes as well as a cable for external sync connections to the scope.

If you have a MODEL III or an early MODEL IV, you may have an FDC board that has adjustable alignment. If so, you can use the diagnostic marked FDCALG to do either a static or dynamic alignment.

Now that you know where to find the information about what to test and adjust, let's discuss where the thingamajigs are on the drive that you twist, pry, or wiggle. We have already talked about the speed adjustment so let's begin our guided tour with the track 00 sensor.

The Track 00 switch is located at the rear of the drive and is glued into position at the factory. It will only require adjustment in the event of switch replacement. Don't fool with it. The Track 00 STOP is not adjustable.

In the illustration that is marked Fig. 3, you will see the position of the two retaining screws, the adjustment cam, and the stepper motor retaining screw. For radial arm adjustment, the two retaining screws are loosened, and the adjustment cam is turned until the "cat eyes" pattern on the scope is within 75%. (Refer to 5.5.3 Head Radial Alignment/CE Alignment in the Model IV Service Manual)

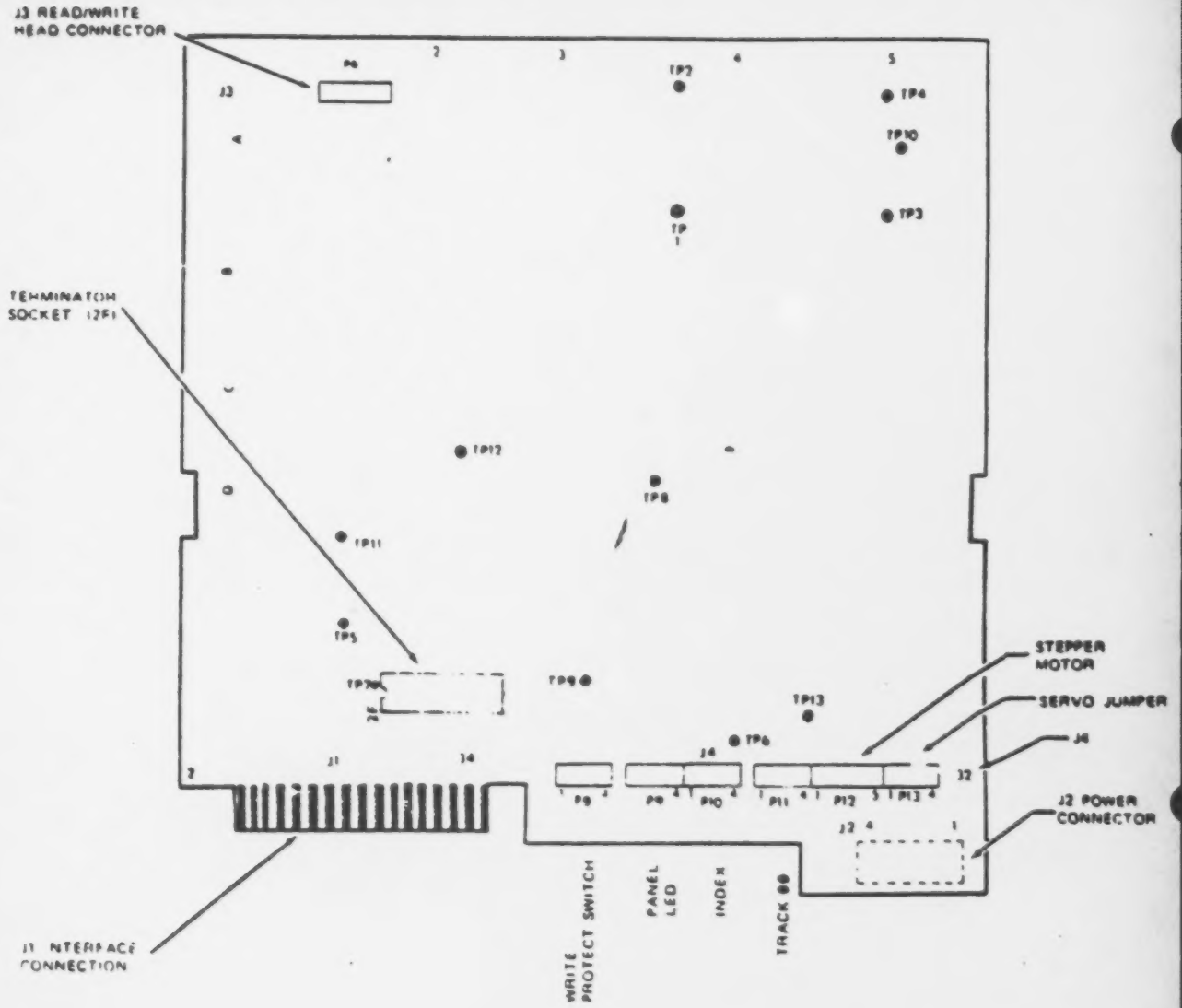


T-7

82

83

FIG. 1



COMPONENT SIDE

FIGURE 2. LOGIC BOARD TEST POINTS AND CONNECTOR LOCATIONS

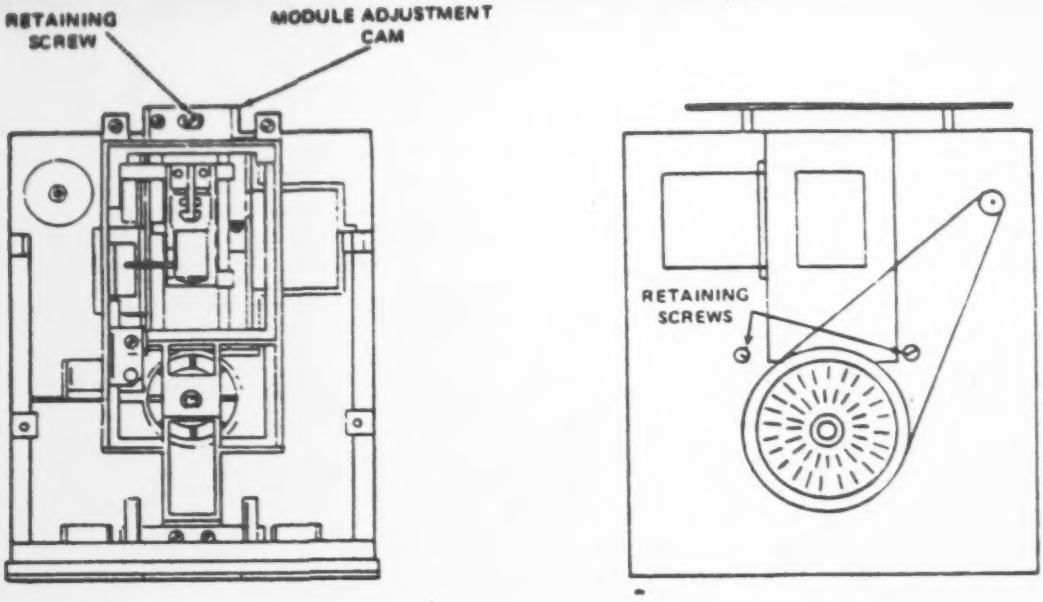


FIGURE 3 RADIAL ADJUSTMENT

Once you have this drive apart and see what a pain it is to get to it, you might consider replacing the felt pads that hold the disk in contact with the head. They are located on the opposite side from the read/write head and they become worn as a natural course of events. They are also inexpensive and easily replaced. When they become worn the pads can cause read/write errors. Just a hint, huh?

Also, the speed adjustment can be done by observing the speed disk on the spindle pulley under fluorescent lighting. The outer ring on the speed disk should appear stationary when the drive is running. If it does not appear stationary, adjust R54 until it does.

By the way, the FDC chip that we mentioned a while back is marked U6 on the FDC board and is a 1793 FDC chip. Make sure that you have marked all the connections to the board and replace everything as it was before closing. As we leave the sunny, exotic shores of FDC Land and its colorful inhabitants, it's time to talk of those other "tidbits thrown in along the way" that I promised.

MEMORY UPGRADES

Memory upgrades are a little more complicated for the Model IV than the Model III but not much. To upgrade from 16K to 64K on the Model IV, remove U77 through U84. Move jumpers
E5-E6 to E5-E4
E1-E2 to E2-E3
E12-E13 to E12-E11
and add jumpers E7-E8.
Add eight Tandy #8040665 64K ram chips (or any 200-250 nanosecond access time RAMS) in locations U77 through U84, then remove capacitors C68, C72, C76, C80, C84, C88, C92, and C96.

To upgrade from 64K to 128K, remove shunt at U72, and add IC Tandy #8075468 in its place. This is a Programmable Array Logic (PAL) Chip and you should make sure you get the one with the yellow lettering and not the white lettering. Add eight RAM chips (see above) in locations U85 through U92.

For the Model III, you may upgrade to 32K or 48K. On the main board you will see three banks of RAM sockets labelled U7 through U14, U25 through U32, and U43 through U50. Simply fill in the second or second and third banks with the new 16K RAM chips (Radio Shack parts #AXX3021) and you're in business. Note: make sure the chips are properly oriented. That is, the number 1 pin is in the number 1 socket hole.

Speaking of RAMS, I'm sure you know that computers do all their magic by creating, manipulating, and referencing an either "on" or "off" state. Since the RAM used by the TRS-80 is dynamic (with the exception of the video RAM), the "on" or "off" states must be periodically updated. While not completely accurate, think of it as a tiny capacitor that stores a charge. Once the source of power is removed, the charge will leak away unless it is "refreshed". That is exactly what happens with dynamic RAM. The "charge", if you will; represents a logical 1, and no charge, a logical 0. The refresh rate of the RAMS in the TRS-80 is two milliseconds. As you can see, timing is everything. If you are interested you might follow the schematics and check the clocking frequency at different places. The interlocking systems are beautifully complex and will give you a headache.

There are three useful diagnostic tests on the Model 4/4D/4P diagnostics disk that test the Model III's Random Access Memory. They are MEM6, BURNIN, and DMT. I suggest you use them in that order beginning with the quick test of MEM6. On the same disk is MEM4 and BD16K for the Model IV. BURNIN must first be transferred to tape or you can use TDMT/DDMT which is the tape version of the dynamic memory test and which is also available for your use. They are all easy to use and are explained thoroughly in the documentation. An intermittent memory problem can be a pain to locate but these tests combined with the patience of Job can usually do the trick.

VIDEO

Oh, by the way, you remember us talking about getting fried messing with the tube? Well the really dangerous area is on the video tube where you see a wire entering somewhere on the bell-shaped part of the tube. There is a rubber nipple covering the wire where it enters the tube. To discharge it, (the computer is off and unplugged, right?) simply take a screwdriver with an insulated handle and using a piece of wire with an alligator clip at each end, attach one end to the blade of the screwdriver and the other end to a good ground. Stick the end of the screwdriver under the rubber nipple to the center of it. While you're doing this, have your other hand in your pocket. You will hear a crackle of discharging electricity and the first time will probably scare the devil out of you. Wait a little and do it again -- then again each time touching the metal connector under the rubber cover. P.S. If you get shocked, forget where you read this.

On the video monitor printed circuit board which is located inside the housing that also contains the video tube (CRT) are user-adjustable controls for changing focus,

vertical size, vertical hold, and horizontal hold. These controls are marked on the board but can be difficult to locate. For reference, orient the board so the fuse is in the lower left-hand corner. The focus adjustment, R524, is just above and to the left of the fuse. The vertical size adjustment, R617, is about three times as far above the fuse as the focus control and just slightly to the right. The vertical hold (R612) is on the right hand edge of the board and half-way from top to bottom. The horizontal hold which is controlled by the horizontal oscillator coil is just above the vertical hold.

Remember the two little wheels under the left-hand side of the computer? Well, if you ever turned those too far the wrong way, you may have noticed a sharply defined horizontal area in the center of the screen with a few diagonal lines through it. There would be large borders around this bright area. This is called the raster and the text appears within this area. If the spacing of the text from the left side of the raster is not the same as the spacing from the right side of the raster, you can loosen the clamps holding the deflection yoke (the big round thing on the neck of the CRT) and slide the linearity sleeve (the little oblong looking thing in front of the yoke) either backwards or forwards to get equal spacing. Also while you have the yoke loose, if your sense of humor runs to the juvenile, you can turn the whole yoke over and the text on the screen will be upside down.

MISCELLANEOUS

There are two versions of the diagnostics package that has been assembled for loan to schools. Version "A" contains a Model III service manual, a Model IV service manual and the following diagnostic tests: MEM6, NET4, IOTEST, FDCALG, TDC, DSKDG3, DRV4M, HARD DRIVE, RS232C, MEM4, BD16K, and 4/4P PRELIMINARY. All of this comes in a bound notebook with the diagnostics disk in the back. Version "B" contains DMT, BURNIN, MEM6, DT-1 DIAGNOSTICS, IOTEST, FDCALG, TDC, DISKDG5, RS232C, HARD DRIVE, MEM4 and BD16K as well as both Model III and Model IV service manuals in a notebook with the diagnostics disk in the back. Although the different versions have different tests, they are essentially interchangeable.

Either diagnostics package is available on loan and may be checked out for a period of two weeks. The tape version of the Dynamic Memory Test is available separately.

If you have some particularly interesting problem tha. you have resolved, you might consider sharing the solution with others. If you will take the time and trouble to write down (in as much detail as possible) the problem and what you did to fix it, stick it in the package for others to see. I'm sure it will be appreciated.

John Barber
May 1986

TRS-80 is a registered trademark of Tandy Corporation, Ft. Worth, Texas.

PRINTER EMULATION CHART

	TANDY EMULATION SETTINGS	COLOR COMPUTER SETTINGS	NON-TANDY EMULATION SETTINGS	
260-1274 DMP-2100P		NO COLOR COMPUTER MODE	IBM GRAPHICS PRINTER	
260-1275 TRP-100			IBM GRAPHICS PRINTER	
260-1277 DMP-430			IBM GRAPHICS PRINTER	
260-1279 DMP-2200		NO COLOR COMPUTER MODE	IBM GRAPHICS PRINTER	
260-1280 DMP-130 260-1280A DMP-130A 260-2814 DMP-132			IBM GRAPHICS PRINTER	
260-2800 DWP-520		NO COLOR COMPUTER MODE	IBM WHEELPRINTER	
260-2802 DMP-106			IBM GRAPHICS PRINTER	
260-2808 DMP-440			IBM GRAPHICS PRINTER	
260-2810 DMP-2110		NO COLOR COMPUTER MODE	IBM GRAPHICS PRINTER	
260-2812 DWP-230			IBM WHEELPRINTER	
260-2811 DMP-2120 (LCD DISPLAY PANEL)	Emulate - TANDY CR-Code - CR & LF CHR Set - TANDY	NO COLOR COMPUTER MODE	IBM GRAPHICS PRINTER	Emulate - IBM CR-Code - CR ONLY CHR Set - IBM Set 1 or 2
260-2804 LP-1000 Laser (Front Menu Panel)	TANDY MODE, MENU 1, ITEM 1 LF/CR, MENU 3, ITEM 4 TANDY CHAR SET MENU 5 ITEM 1	NO COLOR COMPUTER MODE	IBM PROPRINTER IBM WHEELPRINTER HP LASERJET PLUS IBM CHAR SET MENU 5, ITEM 3/4	MENU 1, ITEM 3 MENU 1, ITEM 4 MENU 1, ITEM 5 LF/CR - MENU 3, ITEM 4

NOTE 1 - In the switch diagrams the black part of the switch indicates the way the switch is to be active. (i.e. - If the ON side is black then the switch should be in the ON POSITION.

NOTE 2 - All printers in this list will toggle emulation modes from software control when the two byte code 1B 21 (hex) is sent. This is a toggle function, and it is up to the operator to know what emulation the printer started from. On the LP-1000 the sequence will toggle emulations when starting from the TANDY/IBM MODEs. There is no way to get to the HP or Wheelprinter mode using software switch codes.

SUGGESTED READINGS, SOFTWARE AND TECHNICAL TRAINING

BOOKS

The following is a portion of possible selections for a school or small district library on the subject of microcomputers. Books with copyrights over two years old should be suspected as semi-obsolete unless revised editions have been produced. The selections below were current as of January, 1987, when this guide was first revised.

Benner, Robert C. Apple II Plus/IIe Troubleshooting and Repair Guide, Copyright 1984, Howard W. Sams Publishing Company, $21.95.

Benner, Robert C. Commodore 64 Troubleshooting and Repair Guide, Copyright 1985, Howard W. Sams Publishing Company, $21.95.

Benner, Robert C. IBM PC Troubleshooting and Repair Guide, Copyright 1985, Howard W. Sams Publishing Company, $21.95.

All three of Benner's guides are excellent references for the computers for which they were written. Tthe Apple and IBM books only include the Apple and IBM computers that existed in 1984 and 1985 unless you find a revised edition with a later publication date. No information is included for Apple IIc or IBM XT's or AT's. I would expect a revision at any moment. Check the copyright date and that your computer type is included BEFORE purchase. In the case of the Commodore 64 guide, or if you have an older machine, the guides have many hard-to-find details and still provide useful information although the price is somewhat high. Especially well thought out are the troubleshooting charts and diagrams.

Williams, Gene B. How to Repair and Maintain Your Apple Computer,Copyright 1985, Chilton Book Company. $12.95.

Includes material on Apple II, II+, IIe, and a brief 10 page chapter on the IIc. No information on Macintosh or IIGS machines. Can be purchased with a diagnostic disk (Computer Checkup) for $49.95. Still a useful manual for schools or individuals.

Williams, Gene B. How to Repair and Maintain Your IBM PC, Copyright 1984, Chilton Book Company. $12.95.

Only covers the IBM PC, not the XT or newer AT models. For example, still only shows two of the three IBM disk drive types and reference is made to DOS 2.0. Solid foundation in IBM (and clone) procedures. Has several useful charts and tables, but look for a needed revision.

The following books have recently been located and may be of some use to those needing to keep Commodore 64's and 128's running in classroom environments.

Margolis, Art Troubleshooting & Repairing Your Commodore 64, Copyright 1985, Tab Books, Inc. $16.95.

Heilborn, John Commodore 128 Troubleshooting & Repair, Copyright 1988, Howard W. Sams Publishing Company, $19.95.

Peltier, Michael G. Commodore 1541 Troubleshooting and Repair Guide, Copyright 1986, Howard W. Sams Publishing Company, $19.95.

MAGAZINES

Any discussion of computer magazines is like going into a Howard Johnson's looking for ice cream. It all depends on the flavor you want. The number of computer publications constantly changes as new machines and new magazines are released to cater to the consumer. The following is merely a list of one or two personal favorite flavors:

General - Byte and Personal Computing both rate examination. Personal Computing has long been a personal favorite. It covers a wide variety of topics and has articles on business as well as educational applications for the "non-technical" reader. Lately it has taken on a definite tilt toward "business" (read IBM) computers, although that seems to be straightening itself out with broader coverage of "alternative" machines.

InfoWorld (P.O. Box 1018, Southeastern, PA 19398) and PCWeek (One Park Ave., New York, NY 10016) are both weekly tabloids devoted to microcomputers. As might by concluded from the titles, PCWeek used to be oriented toward IBM PC's and clones almost exclusively. InfoWorld keeps its readers ahead of developments in more than just IBM and similar computers. Within the last year, both publications have broadened their coverage to include Macintosh and UNIX workstations. Both weeklies neglect the Atari and Amiga markets since both publications are devoted to business. If I had to choose between the two, I'd keep my subscription to InfoWorld.

Micro Cornucopia (P.O.Box 223, Bend, OR 97709-0223) is published every other month. Originally for "build your own" enthusiasts, Micro C has grown up from "Big Board" microcomputers and 8" disks to 32000's. It is technical reading, but Micro C also maintains an excellent (read "tested") library of public domain software in CP/M and now MS-DOS formats.

Machine Specific -

Apple - A+, Incider, MacWorld, MACazine
Commodore - Run
IBM - PC World

DIAGNOSTIC SOFTWARE

Each manufacturer has its own set of diagnostic software. Third parties also make diagnostic software for a variety of machines. The following list is not all inclusive, but contains information about disks this district has used. For example:

Apple Computer, Inc.
(Must be Apple authorized dealer or have participated in Level I training to order) Apple dealers use a very comprehensive set of diagnostic disks to check out both individual computers and disks.

Commodore Business Machines, Inc.
(Must be CBM authorized dealer to order) Commodore Utility Disk.

IBM
(See IBM section for detailed description) IBM produces a detailed maintenance manual and diagnostic disk for each microcomputer system. Manuals and diagnostic routines are complete but designed for component replacement rather than component repair. Each is available, if somewhat costly, to the consumer.

Tandy - Radio Shack
Disk Drive Analyzer Diskettes used to be available in retail stores for TRS 80 Model III/4/4P computers (PN 26-413, $29.95) but are no longer listed in the Tandy Computer Catalog. In its place, a new Disk Drive Analyzer Diskette is offered for the Tandy 1000's with 5 1/4" drives (PN 26-1370, $29.95). Another diagnostic disk (PN 26-217, $29.95) is listed for Tandy 3000 and Tandy 4000 machines. Special diagnostic disks are available to Tandy technicians and other authorized users.

Computer Checkup
(formerly XPS-Diagnostics - See Apple section for description) Neither of these disks is an "authorized" Apple product, but have been widely used. To the best of my knowledge, XPS-Diagnostics is no longer available. When last seen in a Power Up catalog, Computer Checkup is available for both the Apple II series (#A105) and the IBM/Compaq (#I108) for $59.95. The Apple diagnostic disk has been used. The IBM version has not yet been personally tested. The Apple disk is also furnished with How to Repair and Maintain your Apple Computer (Chilton Book Company). Neither program was listed in the lastest Power Up catalog.

Computer Inspector
(MECC, 3490 Lexington Ave. North, St. Paul, Minn. 55126 MECC Product No. A-240) This is a new MECC product released in 1988. It checks Apples from Apple][+'s with 48K to IIGS's. The program is easy to use and teachers can check their own computers very quickly before calling for technicians from the district office. Since Polk County has a district site license for MECC software, copies of Computer Inspector are available in each school in our district in August, 1988.

COMPUTER TRAINING - TECHNICAL SCHOOLS

Each of the major manufacturers offers technical training on repair of their brand of microcomputer through special classes available to school districts and to industry. Most technical training courses have a waiting list and several months may be required for admission. Four of these courses are outlined below.

Apple Computer Inc.
Level I Certification, the same training provided dealer repair technicians, is available to school districts at Apple's Charlotte, NC headquarters. Travel, room and board are not included. Practical hands-on experience is stressed at a reasonable pace for most technical types. Contact your area's Apple sales representative for additional information or Florida schools may write:

Apple Computer, Inc.
2502 Rocky Pointe Drive, Suite 645
Tampa, FL 33607

Commodore Business Machines, Inc.
Commodore now runs training classes for C-64s and C-128s at its West Chester, PA facility. Diagnostics and service manuals are also available. For more information, contact:

Commodore Business Machines
ATTN: Technical Operations
1200 Wilson Drive
West Chester, PA 19380

International Business Machines, Inc.
The IBM three day maintenance workshop is well packaged and complete. (They even provided a box to send all the manuals back home from Atlanta.) The training is excellent and participants willingly would stay longer. At IBM's hourly rate for service ($110.00/hr. in 1986) the training cost was quickly recovered. Contact your district's local IBM representative for current prices and details.

Tandy - Radio Shack

Tandy's training school is located in the Fort Worth national headquarters. Suggested for selected individuals with an electronics background, the six day workshop is said to be intensive with classes on theory as well as the practical points of repair. With the number of new machines from Tandy, the training schedule may be revised. Contact your Tandy Educational Representative for additional information or write:

Radio Shack Educational Division
1400 Tandy Center
Fort Worth, TX 78012

Maintenance Guide Mailing List

County

Title

FirstName LastName

School/Office

Street/POBox

City State Zip

SchPhone Date

Comments

If any errors are found or you have any suggestions to improve the "Troubleshooting Microcomputers" guide, please help us improve this manual by contacting me at the address shown below.

Polk County schools will automatically receive two copies of each update to the guide. If you obtained your guide through attendance at a maintenance workshop and wish to receive a single copy of each update, return a copy of this form to:

B. R. Black, Supv. Inst. Computing
School Board of Polk County
P.O. Box 391
Bartow, FL 33830
phone: (813) 534-2267